

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
SOUTHERN REGION
Screwworm Research Laboratory
P. O. Box 986
Mission, Texas 78572

eat
file

August 16, 1973

Subject: Los Alamos Visit

To: E. A. Taylor, Area Director
Subtropical Texas Area

Attached are documents that Dr. Holm and associates at Los Alamos Laboratory presented for review when Dr. Williams, Dr. Meadows, and I visited there on August 6 and 7 as agreed between you and Dr. Hourrigan for my participation.

The first proposition (budgeted for \$247,500) is of interest since the funding approximates our current budget at Mission. We rejected that whole proposal on the basis of expense. I mentioned that the Gainesville Attractants Laboratory was just starting a preliminary study on sounds produced in a cage with screwworms mating and this preliminary effort was at no charge to APHIS. I said that if the Gainesville work on sounds should prove promising but that if technical difficulties should arise, we might want to call on Los Alamos later for help with special problems. Dr. Holm and Dr. Baldwin seemed agreeable to this.

Dr. Williams committed limited funds to probe radar tracking of screwworms. Also, within that budget a small effort is to be made to develop a color sensor that might discriminate between macellaria, wild screwworms and sterile screwworms. The objective is automation of sorting fly trap catches.

I nominated Mr. Gerald Holt of the Fargo Laboratory to work on transponder marking of screwworm flies. Drs. Williams and Meadows agreed to pay his travel expenses for two weeks of exploratory investigation. Upon my return here, I telephoned Mr. Holt and his supervisor, Dr. Dennis Nelson, Project Leader for Insect Physiology at Fargo. They enthusiastically agreed to cooperate in the effort. Mr. Holt will come to Mission September 3 for two days' planning. He will then go to Los Alamos until September 15 and then return to Fargo. At Fargo, Mr. Holt can continue the work on a variety of insects if the preliminary results are encouraging. Follow-up work on screwworms could be done with

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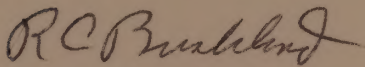
AREA OFFICE
WESLACO, TEXAS

Subject: Los Alamos Visit

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sterile flies shipped to Fargo. Once transponders are developed enough for flight trials with screwworms, Dr. Crystal could do laboratory explorations here and Dr. Meadows would involve his Methods Development group in field studies in cooperation with our research entomologists.

So far, the only demonstration we have seen is one with a tiny loop of wire being whirled by an electric motor, but I believe that it will prove practical to mark the wings of flies with ink used for printing electronic circuits. I think that with Fargo facilities already available, developments can be made without involving huge expenses at Los Alamos.



R. C. Bushland
Research Leader

Enclosures

cc: Dr. Meadows
Dr. Nelson
Dr. Klassen
Dr. Henderson

Subject: Los Alamos Visit

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Enclosures

cc: Dr. Meadows
Dr. Nelson
Dr. Klassen
Dr. Henderson

USDA/LASL INTERACTION

ROLE OF USDA

1. IDENTIFY AND DEFINE PROBLEMS FOR LASL CONSIDERATION
2. SUPPLY EXPERT CONSULTATION
3. SUPPLY FUNDS TO SUPPORT PROJECTS AT LASL
4. SUPPLY MATERIALS, SERVICES, AND FACILITIES NOT AVAILABLE AT LASL
5. COORDINATE PROJECTS AT LASL WITH THE NEEDS OF USDA

ROLE OF LASL

1. SUPPLY FACILITIES AND CAPABILITIES NOT AVAILABLE IN USDA
 - A. PHYSICS AND BIOPHYSICS
 - B. ENGINEERING AND INSTRUMENTATION
 - C. COMPUTER TECHNOLOGY
 - D. BIOLOGY (CELLULAR, MOLECULAR, RADIATION)
2. PERFORM EXPERIMENTS OF MULTIDISCIPLINARY NATURE
3. CONSTRUCT INSTRUMENTATION OF SPECIALIZED NATURE
4. CONSULTATION TO USDA

GENERAL INTERVIEW

DATE: 1/15/78

1. SUBJECT AND DATE OF INTERVIEW AND DATE OF INTERVIEW
2. SUBJECT'S NAME AND ADDRESS
3. SUBJECT'S DATE OF BIRTH AND PLACE OF BIRTH
4. SUBJECT'S EDUCATION AND OCCUPATION
5. SUBJECT'S RELIGION
6. SUBJECT'S POLITICAL BELIEFS
7. SUBJECT'S SOCIAL AND ECONOMIC STATUS
8. SUBJECT'S CURRENT AND PAST EMPLOYMENT
9. SUBJECT'S CURRENT AND PAST RESIDENCE
10. SUBJECT'S CURRENT AND PAST ASSOCIATIONS
11. SUBJECT'S CURRENT AND PAST ACTIVITIES
12. SUBJECT'S CURRENT AND PAST INTERESTS
13. SUBJECT'S CURRENT AND PAST ATTITUDES
14. SUBJECT'S CURRENT AND PAST BELIEFS
15. SUBJECT'S CURRENT AND PAST OPINIONS
16. SUBJECT'S CURRENT AND PAST ACTIONS
17. SUBJECT'S CURRENT AND PAST REACTIONS
18. SUBJECT'S CURRENT AND PAST FEELINGS
19. SUBJECT'S CURRENT AND PAST THOUGHTS
20. SUBJECT'S CURRENT AND PAST BEHAVIOR

DATE: 1/15/78

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19. SUBJECT'S CURRENT AND PAST BEHAVIOR

Proposal for

IDENTIFICATION AND ATTRACTANT TECHNIQUES FOR *COCHLIOMYIA HOMINIVORAX*

To be performed under an interagency agreement between:

The U. S. Atomic Energy Commission-Division of Biology and Medicine

and

The U. S. Department of Agriculture-National Animal Disease

Laboratory (Diagnostic Services)

AEC Contractor: University of California, Los Alamos Scientific Laboratory,
Los Alamos, New Mexico

December 1971

Proposal for

ACQUISITION OF LANDS IN THE STATE OF CALIFORNIA

IN THE COUNTY OF ALBANY, STATE OF CALIFORNIA

The U. S. Forest Service, Department of Agriculture

and

The U. S. Department of Agriculture, Bureau of Land Management

Propose to acquire

the following described lands, to-wit:

The Albany, New York

December 1911

SCOPE:

A one-year project is proposed to determine the feasibility of different methods for identifying plant-produced screwworm flies that have been collected in traps in the field and to investigate methods of improving attraction and collection of screwworm flies. The work will be directed along three lines: (1) tagging and identification of plant-produced flies; (2) electronic sensing and analysis of sound signals; and (3) isolation and identification of attractants. Non-radioactive materials will be fed to the plant-produced flies, and these will be identified by activation analysis methods. For the sound sensing, different species of flies will be monitored to see if there are any characteristic sounds of feeding, mating, flying, or larval feeding that could be used to attract or sort screwworm flies. If suitable tags can be found for identifying plant-produced flies and improvements realized in efficiency of trapping, then it will be much easier to evaluate and improve the effectiveness of the screwworm fly eradication program.

BACKGROUND:

Screwworms are the larvae (maggots) of the fly *Cochliomyia hominivorax*. They are true parasites, feeding only on the living flesh of warm-blooded animals. Infested, untreated animals may die. In the spring of 1962, a program was started to eradicate screwworms from Arkansas, Louisiana, New Mexico, Oklahoma, and Texas. This was a much more complex and difficult undertaking than the elimination of the pest from the Southeastern states. In the Southeast, screwworms usually were able to survive through the winter only in peninsular Florida. Water on three sides and cold weather on the north acted as effective barriers.

The Southwestern states have no such advantages. The screwworm population in the Republic of Mexico provides a constant threat of reinfestation. It was estimated that screwworms caused an average annual loss of \$100 million to the livestock industry before the beginning of the screwworm eradication program. The cost of eradication and subsequent maintenance of a sterile screwworm fly barrier has been about \$6 million a year.

While the screwworm irradiation program has been very effective in reducing the number of cases of screwworm fly infections, it has been difficult to obtain data on the dynamics of the program so that improvements in techniques can be generated and evaluated. One of the major sources of information is obtained by setting up fly traps at strategic locations and counting the number of screwworm flies trapped and from this number determining how many were plant-produced screwworm flies. Present techniques involve hand-sorting trapped flies into screwworm and non-screwworm types. Screwworm flies are further analyzed by crushing and extracting a dye with acetone to see which were plant-produced. Hand-sorting of flies is both difficult and time-consuming, and very few screwworm flies are trapped by current methods. Thus, improvements in attraction, collection, and tagging of the flies are needed. Effective methods of attraction, collection, and sorting for more efficient utilization of those now produced, resulting in continued analysis of data for program evaluation, could provide meaningful economic impact on the program in a very short time frame.

Preliminary experiments at the Los Alamos Scientific Laboratory indicate that plant-produced flies contain no detectable bromine activity when examined by neutron activation and X-ray fluorescent methods, whereas all wild flies examined in these experiments showed high bromine contents. A less dramatic but yet significant finding was in the amount of manganese activity seen in the

The first group of subjects was given a series of tests in which they were required to identify the position of a point on a grid. The results of these tests were used to determine the accuracy of the subjects' responses. The second group of subjects was given a series of tests in which they were required to identify the position of a point on a grid. The results of these tests were used to determine the accuracy of the subjects' responses. The third group of subjects was given a series of tests in which they were required to identify the position of a point on a grid. The results of these tests were used to determine the accuracy of the subjects' responses.

While the results of the tests were being analyzed, it was found that the subjects' responses were not always accurate. This was due to a number of factors, including the complexity of the task and the subjects' lack of experience. In order to improve the accuracy of the results, it was decided to repeat the tests with a larger number of subjects. The results of the repeated tests were used to determine the accuracy of the subjects' responses. It was found that the accuracy of the results was improved when a larger number of subjects were used. This was due to the fact that the subjects' responses were more consistent when a larger number of subjects were used. The results of the repeated tests were used to determine the accuracy of the subjects' responses. It was found that the accuracy of the results was improved when a larger number of subjects were used. This was due to the fact that the subjects' responses were more consistent when a larger number of subjects were used.

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respective groups. All plant-produced screwworm flies had considerably less manganese than wild flies. It is suspected that bromine originates from tetra-ethyl lead in gasoline combustion as an atmospheric pollutant and that wild flies somehow concentrate this either within the body or on the body surfaces. These experiments suggest that bromine-like elements such as iodine could be incorporated on or in the flies, as the case may be, to serve as a specific tag for plant-produced flies.

The general problem of attracting and sorting wild screwworm flies is not as clearly defined as the problem of identifying plant-produced flies. It is known that both sound and olfactory signals are used by insects as attractants and navigational aids, and these might be suitable for increasing the collection efficiency of the traps. Since it is possible that sound might be a useful stimulant or signature, it should be looked into by both a literature search and a laboratory experimental survey of sounds emitted by the flies. Personnel at LASL have extensive experience in electronics circuitry, sound ranging, and wave form analysis that will be germane for the acoustic investigations. In the area of identification of chemical attractants, LASL has considerable experience that can be brought to bear. Our scientists have already determined by X-ray diffraction the crystal structure of 9-keto-trans-2-decenoic acid, the pheromone of the honeybee, and have done preliminary work on a synthetic attractant for the Mediterranean fruit fly. Other biological molecules worked on are ATP (adenosine triphosphate) and some steroids in collaboration with a group at Cambridge University. Other possible projects have been discussed with Dr. Morton Boroza of the Department of Agriculture at Beltsville, Maryland. Dr. Boroza has done much work on the isolation and characterization of insect attractants.

LASL facilities include flame ionization and thermal conductivity detection,

analytical gas chromatography, and medium- and large-scale preparative gas chromatography. This equipment could be used for fractionation of mixtures and collection of working quantities of specific compounds. Excellent thin-layer chromatography (TLC) facilities are also available, including direct dual-beam photometry under both visible and ultraviolet light. Inlets for pyrolysis and pyrolysis-hydrogenation are available for use with gas chromatography to aid in structure determinations. LASL also has elemental and thermal analysis and optical, microscopic, and X-ray equipment.

Chromatographic fractions identified by USDA as having attractant properties can be identified by a combination of techniques [e.g., mass spectrometry (using a CEC 21-110 high-resolution spectrometer), nuclear magnetic resonance spectrometry (nmr), and ultraviolet-visible-infrared spectrophotometry]. Group CNC-4 is capable of doing high-resolution proton nmr and ^{13}C nmr at the natural abundance of the isotope. The positions of double bonds can be determined by combined chemical and instrumental methods.

While these proposed experiments do not attempt to solve all important problems in this program, they will initiate the LASL personnel and promote thinking along new areas of research.

PROJECT TIME SCHEDULE:

The one-year running time of the project is proposed so that adequate time will be available from conclusion of one experiment to start of another. It is expected that any of the experiments can be conducted throughout the year so that it is not necessary to wait for summer. Since this proposal is a group of feasibility studies, it is important that feedback from one experiment be incorporated in the next. However, activation, acoustic, and attractant experiments

can be done concurrently. The one-year time scale also makes it easier to fit these experiments in with priority requirements of established LASL commitments.

THE PROPOSAL:

The Los Alamos Scientific Laboratory recommends to the Division of Biology and Medicine of the United States Atomic Energy Commission (AEC) that the existing interagency cooperative agreement between the AEC and USDA be extended for the purpose of investigating methods for evaluating and improving the screwworm fly eradication program. Improvements would be sought in identification of plant-produced screwworm flies and in methods of attracting and sorting all screwworm flies in the presence of other flies. The project would extend over a one-year period and would involve active cooperation between the USDA and LASL. The USDA would assign a project officer at the USDA Mission, Texas, facility to provide cooperative support for the project. In particular, the USDA through the existing liaison office at LASL would:

- (1) supply the necessary insects.
- (2) supply the attractants.
- (3) assist in conducting the atmospheric tests.
- (4) supply traps and cages.
- (5) provide knowledgeable technical assistance within their expertise.

The LASL would:

- (1) suggest appropriate non-radioactive tagging materials for incorporation into the flies after consultation with USDA entomologists.
- (2) examine the flies for the tagging materials.

THE PROJECT:

The first objective of the project is to establish a working relationship between the two organizations. This will be achieved by the exchange of information and the sharing of resources. The second objective is to develop a joint research program. This will involve the identification of common research interests and the establishment of a joint research committee. The third objective is to develop a joint training program. This will involve the identification of common training needs and the establishment of a joint training committee. The fourth objective is to develop a joint publication program. This will involve the identification of common publication interests and the establishment of a joint publication committee. The fifth objective is to develop a joint conference program. This will involve the identification of common conference interests and the establishment of a joint conference committee. The sixth objective is to develop a joint grant program. This will involve the identification of common grant interests and the establishment of a joint grant committee. The seventh objective is to develop a joint award program. This will involve the identification of common award interests and the establishment of a joint award committee. The eighth objective is to develop a joint fellowship program. This will involve the identification of common fellowship interests and the establishment of a joint fellowship committee. The ninth objective is to develop a joint visiting professor program. This will involve the identification of common visiting professor interests and the establishment of a joint visiting professor committee. The tenth objective is to develop a joint sabbatical program. This will involve the identification of common sabbatical interests and the establishment of a joint sabbatical committee.

- (1) Supply the necessary facilities.
- (2) Supply the necessary materials.
- (3) Assist in conducting the research work.
- (4) Supply trips and travel.
- (5) Provide knowledge and technical assistance to their respective organizations.

THE LAST PART:

- (1) Supply the necessary facilities and materials for the research work.
- (2) Assist in conducting the research work.
- (3) Supply trips and travel.
- (4) Provide knowledge and technical assistance to their respective organizations.

- (3) conduct experiments to determine the dynamics of uptake of the tag.
- (4) investigate different methods for detecting tagged flies.
- (5) investigate methods of identification of attractants.
- (6) investigate the use of sound in attraction and sorting.

The first phase of the identification experiments will be to determine the relative abundance of all detectable natural elements and the site of bromine incorporation on wild flies (that is, to decide whether bromine is a surface absorption or if it is in the cuticle or interior body of the fly). It is advisable to obtain this information so that we can determine the proper induction mode of iodine to the fly. Concurrent with this investigation will be determination of the time-history of uptake of bromine to see at what rates it is normally acquired in the field. This will assist in the programming of iodine incorporation. Similar information on manganese uptake would also be obtained. The second phase of these experiments will be to investigate different methods of incorporating iodine into the fly, and a third set of experiments would be designed to find other tag elements that might be better for identification.

For acoustic experiments, live groups of flies would be placed in an anechoic chamber and recordings made of the flying sound. The different species of flies would be compared to see if there is a characteristic difference perhaps due to morphology of the wings. In the course of these experiments, sounds of feeding, mating, etc., would be looked for, and if any promising results were obtained these would be investigated sufficiently to see if additional work is justifiable. These acoustic experiments would be conducted in three frequency domains that are determined by the equipment needs. The first domain would include frequencies in the audio range up to 18 KHz. It would be done with the existing equipment and

construction of a small anechoic chamber. A literature search would be performed concurrently with this work. The second domain would extend the frequency range up to 40 KHz and would require modest equipment acquisition and incorporation of additional equipment on hand such as a fast tape recorder and use of a small computer. The third domain would involve extending the bandwidth up to 250 KHz, which is the maximum that has been reported in the literature. The last phase of the work would require more time to acquire and set up equipment than the first two.

For the attractant studies, we propose to start with materials furnished by USDA that are known to contain attractants. Both the attractant(s) produced in bovine blood and the sex attractant could be studied. Some considerable advantage should accrue from a primary emphasis on a study of the sex attractant because its identification would allow the trapping of specific flies. The enriched materials would be purified by use of chromatography, and identifications would be made by applying nuclear magnetic resonance, mass spectroscopy, X-ray crystallography, and any other methods deemed desirable.

If these preliminary experiments are successful, then additional proposals would be generated to cover subsequent work in those areas.

MANPOWER AND COST ESTIMATES:

Since this proposal involves different aspects and efforts by different divisions, these efforts are separated into manpower and cost estimates.

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CONCLUSIONS AND FURTHER STUDIES:

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MANPOWER AND COST ESTIMATES

X-Ray Fluorescence Studies

1 Staff member (half time), Group A-1	\$27,000 (expense)
1 Technician (full time), Group A-1	29,000 (expense)
200 hours accelerator time at \$50/hr	10,000 (expense)
X-ray detector	2,500 (expense)
Liquid nitrogen dewar for X-ray detector	1,000 (capital equipment)
Amplifier system for detector	1,000 (capital equipment)
	<u>70,500</u>

Neutron Activation Studies

1 Staff member (quarter time), Group CNC-11	<u>18,000 (expense)</u>
	18,000

Molecular Structure Studies

Chromatographic and nmr studies in Groups GMX-2 and CNC-4	
1 Staff member (quarter time)	13,000 (expense)
X-ray diffraction studies in Group CMB-5	
1 Staff member (full time)	39,000 (expense)
Computer time	5,000 (expense)
Low-temperature equipment	<u>10,000 (capital equipment)</u>
	67,000

Biological Monitoring of Project

Entomologist consultant	2,000 (expense)
Pathologist (0.1 staff member year), Group H-4	<u>4,000 (expense)</u>
	6,000

Sound Experiments

Audio frequency domain (1.5 ceiling points, quarter time)	
18-40 KHz domain (1.5 ceiling points, quarter time)	
40-250 KHz domain (1.0 ceiling point, full time)	75,000 (expense)
Microphone and tape head	1,000 (expense)
Equipment	<u>10,000 (capital equipment)</u>
	86,000

GRAND TOTAL

\$247,500

USDA

Associate scientist (0.1 staff member year)

Accountant Assistant (0.1 staff number years)

1954

GRAND TOTAL

11.1.50

50,000
10,000 (capital equipment)
1,000 (expenses)
1,000 (expenses)

Equipment and spare parts
10,000 (capital equipment)
1,000 (expenses)
1,000 (expenses)
10,000 (capital equipment)
1,000 (expenses)
1,000 (expenses)

5,000
4,000 (expenses)
1,000 (expenses)

Group B-2
Technician (0.1 staff number years)
Technician Assistant (0.1 staff number years)

50,000
10,000 (capital equipment)
1,000 (expenses)
1,000 (expenses)
1,000 (expenses)

Investment in equipment
10,000 (capital equipment)
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1,000 (expenses)

10,000
10,000 (expenses)

Group B-1
1 staff number (0.1 staff number years)

10,000
1,000 (capital equipment)
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1,000 (expenses)

Investment in equipment
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DRAFT OUTLINE FOR DISCUSSION

Subject: Methods to Enable Study of the Natural Behavior of the Screwworm Fly (Cochliomyia hominivorax) to Effect its Eradication

PROPOSED METHOD

We consider that the development of a hand-held insect tracking radar instrument is technically feasible. Such a device may allow an investigator to maintain contact with a marked fly under normal field conditions. Small hand-held doppler radar receiver transmitters are currently available from commercial sources which might be adapted to the purposes of this study. The following specific objectives have been assumed:

1. It is desired to observe behavior of both female and male screwworm flies during their natural life under normal conditions. This behavior is to be related to weather conditions, wind velocity, humidity or moisture levels and ambient temperature ranges.
2. Flies are to be observed during breeding activity and also during female selection of the larval host.
3. We assume that little is known of the nocturnal activity of these insects.
4. The instrumentation may be used to determine

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habitat preferences, total range of movement during the fly's lifetime, the proportion of time in flight, and to provide cues as to the various conditions which influence the behavior of both male and female flies.

BASIC DATA NEEDED

1. A method of marking individual flies to provide a reflection of the radar energy must be developed for this program to be successful. This marking will probably consist of a metallic paint, fine wire or foil. Information as the best location for the radar target on the body of the insect must be developed, together with an understanding of the maximum loads which might be carried by the insect.
2. For an optimum signal to be generated, it would be desirable to attach a minute amount of radar reflecting material to the wings of the fly; whether this is possible without modification of flight behavior must be determined.
3. We must obtain a preliminary estimate of the wingbeat frequency over normal ranges in order to optimize the receiver tracking circuitry.
4. We must determine the maximum range at which an investigator can maintain contact with a fly

habitat preferences, total range of movement
 between the fly's flight, the proportion of
 time in flight, and to provide data as to the
 various conditions which influence the behavior
 of both male and female flies.

BASIC DATA NEEDED

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 a reflection of the radar energy must be developed
 for this program to be successful. This marking
 will probably consist of a metallic paint, fine
 wire or foil. Information as to the location
 for the radar target on the body of the insect
 must be developed, together with an understanding
 of the maximum loads which might be carried by
 the insect.

2. For an optical signal to be generated, it would
 be desirable to attach a minute amount of radar
 reflecting material to the wings of the fly;
 whether this is possible without restriction of
 flight behavior must be determined.

3. We must obtain a preliminary estimate of the
 highest frequency over which ranges in order
 to establish the receiver recording sensitivity.

4. We must determine the possible range at which an
 investigator can maintain contact with a fly

under natural conditions.

5. We expect that it will be difficult to locate a stationary fly with the techniques considered at this time.
6. The length of time which the tracking instrumentation will be operated will have to be determined prior to the design of a prototype for field evaluation.

OUTLINE OF DESIGN STUDIES

Once the basic preliminary data has been assumed or determined by measurement, certain engineering analysis studies can be performed with the following objectives:

1. Selection of optimum radar frequency.
2. Evaluation of signal processing and display methods, to include phase lock detection of wingbeat modulation.
3. Consideration of automatic directional control of the radar beam.
4. Consideration of target range display.
5. Design, testing and evaluation of a prototype instrument.

DEMONSTRATION OF DOPPLER RADAR TRACKING WITH
SIMULATED FLIES

1. Discussion of targets
2. Description of radar components and information display, to include an oscilloscope presentation and loudspeaker.
3. Discussion of range to simulated targets.

EQUIPMENT DEMONSTRATION

ADMINISTRATION OF DOCTRINE AND POLICY
IN THE ARMY

1. Discussion of targets
2. Description of target documents and information
display, to include an outline of the target
and its location
3. Discussion of target to eliminate target

ADMINISTRATIVE INFORMATION

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
SOUTHERN REGION
701 LOYOLA AVENUE
P. O. BOX 53326
NEW ORLEANS, LOUISIANA 70153

August 17, 1973

Subject: Screwworm Research

To: T. W. Edminster, Administrator

As you know, the screwworm eradication program conducted by APHIS suffered a very serious setback last year in Texas and has been in difficulty this year in Arizona and New Mexico. During this period the U. S. signed an agreement with Mexico whereby the screwworm eradication program will be extended in Mexico down to the Isthmus of Tehuantepec. And, of course, Congress has increased the USDA/APHIS budget to provide for the extended operational program.

During the past few years we increased support for the screwworm research program by about 25 percent; however, this increase was rather modest considering the increased cost of operations during recent years. Regardless, the increase is not enabling us to keep pace and provide solutions to the problems being encountered by APHIS. Now that the operational program is moving into Mexico, there will undoubtedly be an increasing need for ARS research.

In anticipation of the increased need, our Sub-Tropical Texas Area gave screwworm first priority in their FY75 budget request, a proposed increase of 3 SMY. SR also placed screwworm first in priority in the beef cattle package request. We do not know if this important work became a part of the ARS FY75 budget proposal to the Department. Also, during the recent discussions to develop a \$1.1 million meat animal program for FY74, we gave screwworm a high priority rating. So far as we are able to determine, it was not included in the package finally developed. And yet, if not kept out of the U.S., screwworm will have a decidedly adverse impact on our livestock industry in the Southwest and South.

Even if our FY75 proposed increase is included in the budget, scientists at Mission are beginning to wonder if we can meet the demands

that APHIS may have for research. The attached statement, "Screw-worm Research", was prepared by those specialists in an effort to delineate the type of research program that will be necessary to provide solutions to the problems that will be encountered in Mexico and some that continue to occur in the U.S.

Since ARS research does support the operational program, we would be interested in learning the type and magnitude of problems that Dr. F. J. Mulhern and his top staff anticipate. We would greatly appreciate it if your office would discuss ARS projections with Dr. Mulhern in order to obtain his and your reactions to our concerns. The ARS Mission scientists are working closely with the APHIS Mission operational people, but we feel sure they would benefit by feedback from the top.

A. W. Cooper

A. W. Cooper
Deputy Administrator

Enclosure

It is difficult to have for research. The original statement, "There
were problems", was repeated by those scientists in an effort to
highlight the type of research program that will be necessary to pro-
vide solutions to the problems that will be encountered in Mexico
and some that continue to occur in the U.S.

Dr. A. W. Coover has supported the operational program, we would
be interested in learning the type and magnitude of problems that
Dr. J. J. Johnson and his team are studying. We would greatly
appreciate it if you could discuss AAS projects with
Dr. Johnson in order to obtain his and your reactions to our comments.
The AAS Mission scientists are working closely with the ASME Mission
operational people, but we feel that they would benefit by feedback
from the top.

A. W. Coover
Deputy Administrator
Bioscience

SCREWORM RESEARCH

The ARS Screwworm Research Laboratory at Mission, Texas, was established in FY 1963 with a budget of \$200,000. Its mission was, and still remains, research in support of the APHIS screwworm eradication program in the Southwest. For FY 1974, the tentative budget is \$256,500 to support 5 SMY. This budget has not permitted ARS research to keep pace with the APHIS screwworm eradication program that ARS is obligated to support. The APHIS screwworm eradication program started in 1963 with an annual budget of \$5 million. In FY 1973, the budget was \$9 million. With the Mexico operation included, the FY 1974 budget is approximately \$16 million. ARS responsibilities and fiscal needs to support the program have increased in the same proportion.

Eradication effort has been experiencing difficulties. Last year, there were 96,625 cases of screwworms identified in Texas on the basis of samples mailed to Mission program staff. There were, undoubtedly, many more unreported cases. This season, preceded by a cold winter, the situation is not so acute in Texas but Arizona and New Mexico are experiencing the worst screwworm year since the program started. Field tests made jointly with APHIS near Tampico and Victoria, Mexico, in the spring of 1973 showed that only 50% of the wild females mated with sterile males--even though trapping studies showed that sterile flies outnumbered wild flies more than 300 to 1. The continued increase of screwworm cases in Texas since the end of winter suggests that the released flies are not fully competitive. We do not know why.

Genetic research. There is a growing literature of insect genetics which reports that insects lose field adaptability through natural selection as they become adapted to laboratory colonization and mass rearing. Quite possibly, a loss of competitiveness among sterile screwworm flies is due to genetic deterioration in the laboratory. The new technique of isozyme analysis makes available biochemical markers to trace genetic changes in laboratory populations. Preliminary research indicates that ARS should initiate studies of biochemical variability in new field collections, and test each generation in the laboratory to assure that those field characteristics are maintained. Such research would require a full-time biochemist and support staff.

Mexico eradication program will add new problems. In November 1974, a new rearing plant is scheduled for completion at Tuxtla, Gutierrez, in the Isthmus of Tehuantepec. This plant is to produce 300 million sterile flies weekly to compete for mates against the wild population of southern Mexico. There is zero research knowledge regarding specifics on genetics, ecology, mating behavior, population density, etc., for this area. ARS has done no research south of the state of Vera Cruz and neither has anyone else. We have very little knowledge of screwworms along

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the whole Pacific Coast of Mexico. The difficulties that APHIS has encountered in the screwworm eradication effort in Puerto Rico have highlighted our lack of knowledge about screwworm in tropical areas.

Ecological research. We need many field samples of screwworms from southern Mexico and the Pacific coast for genetic comparison. It is essential that the flies to be sterilized and released in those new areas of Mexico match the heredity of the populations in which they will compete for mates. At the earliest possible date, field samples of new insect stocks should be collected from varied ecological situations. In addition, strains of sterilized flies should be field tested for mating competitiveness in all the varied environments of Mexico. Such research should also involve investigations of any peculiarities of screwworm biology in these new, previously unstudied, environments. These studies would require two bilingual insect ecologists--one for northern and one for southern Mexico.

Research on breeding stocks. The genetic and ecological research mentioned above should tie directly into research to develop new breeding stocks that could be infused into the APHIS operational program whenever needed. Initially, 3 genetically distinct breeding stocks, called production strains, should be developed--each from 20 or more field collected egg masses. Maintenance of genetic purity would require separate rearing facilities. A fourth rearing facility equivalent to those used for the separate strains would be used to develop new colonies and test new procedures. These would be reserve strains, built-up and field tested as candidate replacements for production strains.

Each production strain would be replaced by a newer strain within two years in order to maintain breeding stocks as nearly wild-type as possible. In order to conduct the required research, the production strains would be of such size that they would also provide APHIS with one million eggs per day. APHIS could rear to the adult stage and, by blending the three strains, stock the rearing colony with flies whose offspring would have hybrid vigor. This extremely important activity, directly tying ARS research and APHIS operations, would require one entomologist and support staff for rearing.

The APHIS program would directly and immediately benefit from the genetics studies because the eradication plant would get all of its breeding flies as pedigreed eggs each day. As additional benefits, success will guide other ARS and SAES insect colonizers working with other forms of biological control, such as parasites and predators. Also, fundamental science would benefit since university scientists, not concerned with practical insect control but intellectually curious about evolution, speciation, genetics of behavior, etc., would follow ARS work closely. In the past following ARS research they have expressed special excitement about genetic changes in laboratory populations.

The whole scientific system of research. The scientific method has been developed in the natural sciences and is not in the social sciences. The scientific method is based on the following principles:

1. Observation. The first step in the scientific method is observation. It is the process of gathering information about the world around us. Observation can be done in many ways, from simple observation to the use of sophisticated instruments. The key to observation is to be objective and to record what you see without any preconceptions.

2. Hypothesis. A hypothesis is a statement that can be tested. It is a prediction about what will happen in a certain situation. A hypothesis is usually based on previous observations and knowledge. It is important to make a hypothesis that is specific and testable. A hypothesis that is too vague or too broad cannot be tested.

3. Experiment. An experiment is a test of a hypothesis. It is a controlled situation in which the hypothesis is tested. The experiment is designed to test the hypothesis by changing one variable and seeing what happens. The key to a good experiment is to control all other variables so that the only change is the one being tested.

4. Conclusion. The conclusion is the result of the experiment. It is a statement about whether the hypothesis was supported or not. The conclusion is based on the data collected during the experiment. It is important to be honest about the results, even if they do not support the hypothesis. The conclusion is the final step in the scientific method.

Physiological research. We do not yet have a bait better than decomposing liver for APHIS to use to keep track of fly populations. Liver does not attract male screwworms. While it attracts female screwworm flies, it also attracts huge numbers of ordinary blow flies. This fact alone makes it impractical to monitor eradication progress with fly traps. For efficiency in research, we need a more selective bait. To follow male fly activity, we need a male attractant.

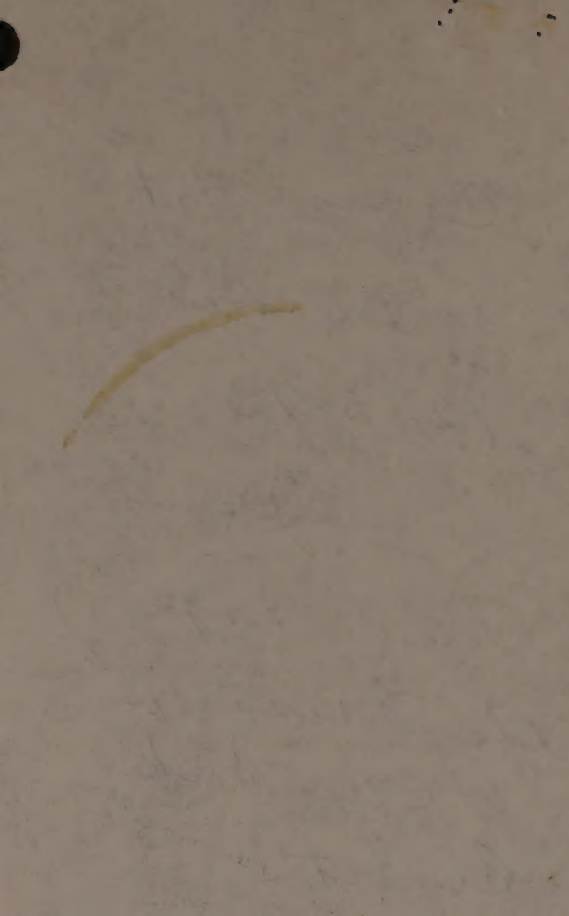
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Copy sent
to Dr. Snow
12-3-73.

Quanto

Plus a copy of
the Mission
WRA Work
Report—



UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
SOUTHERN REGION
701 LOYOLA AVENUE
P. O. BOX 53326
NEW ORLEANS, LOUISIANA 70153

20 AUG 1973

File

RC3

August 17, 1973

Subject: Screwworm Research

To: T. W. Edminster, Administrator

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Since ARS research does support the operational program, we would be interested in learning the type and magnitude of problems that Dr. F. J. Mulhern and his top staff anticipate. We would greatly appreciate it if your office would discuss ARS projections with Dr. Mulhern in order to obtain his and your reactions to our concerns. The ARS Mission scientists are working closely with the APHIS Mission operational people, but we feel sure they would benefit by feedback from the top.

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Deputy Administrator

Enclosure

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estimate the type of research program that will be necessary to
solve solutions to the problems that will be encountered in Mexico
and some that continue to occur in the U.S.

Since AAS research does support the operational program, we would
be interested in learning the type and the degree of problems that
Dr. F. J. Muthart and his staff encounter. We would greatly
appreciate it if you could discuss AAS projections with
Dr. Muthart in order to obtain his and your reactions to our concerns.
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A. W. Cooper
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APHIS

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New Building and Equipment for Screwworm Breeding Colonies

Expanded Research for Screwworm

80' x 60' building

(Estimated by Joe Saitchey, State Architect)

5 SMY at \$65,000 per SMY - - - - - \$325,000

Total - - - - -

\$ 75,000

New Positions Needed

2 Entomologists GS-12 (Mexico, field)

1 Entomologist GS-12 (Physiology)

1 Entomologist GS-12 (Laboratory Rearing)

1 Biochemist GS-12 (Isozyme studies)

1 Technician GS-7 (Laboratory Rearing)

3 Technicians GS-5 (Laboratory Rearing)

3 Technicians GS-3 (Laboratory Rearing)

3 Technicians GS-1 (Fly Sorting)

1 Laborer WB-2 (Laboratory Janitor)

1 Clerk GS-3 (Office)

Total - - - - -

108,300

*Rearing Building and Equipment - - - - -

Diet Supplies for New Breeding Colonies - - - - - 65,000

Miscellaneous rearing equipment:

GRAND TOTAL

\$498,300

Small cages

Larva sifters

Larva-pupa separators

*After construction, these funds will be used for additional fly diet supplies and to support expanded ecological studies in Mexico.

GRAND TOTAL - - - - -

Expanded Research for Screwworm

2 SMY at \$65,000 per SMY ----- \$325,000

New Positions Needed

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*Rearing Building and Equipment ----- 108,300

Diet Supplies for New Breeding Colonies ----- 65,000

GRAND TOTAL \$448,300

*After construction, these funds will be used for additional fly diet supplies and to support expanded ecological studies in Mexico.

New Building and Equipment for Screwworm Breeding Colonies

80' x 80' building for breeding stocks:

~~(Estimates by Joe Smithy, APHIS force construction)~~

Building Shell - - - - -	\$ 50,000
Electrical, air-conditioning, plumbing - - - - -	<u>25,000</u>
Total - - - - -	\$ 75,000

Equipment:

Colony cages (APHIS specs.)	36 @ \$530 ea.	- - - - -	\$ 19,080
Rearing vats (APHIS specs.)	21 @ \$130 ea.	- - - - -	2,730
Vat racks (APHIS specs.)	7 @ \$150 ea.	- - - - -	1,050
Bacteriological incubators	4 @ \$300 ea.	- - - - -	1,200
Rearing vats (1/4 size)	12 @ \$ 75 ea.	- - - - -	900
Pupa holding trays	48 @ \$ 10 ea.	- - - - -	480
Larva capture pans	56 @ \$ 10 ea.	- - - - -	560
Media mixers	4 @ \$300 ea.	- - - - -	1,200
Refrigerators	4 @ \$250 ea.	- - - - -	<u>1,000</u>
Total - - - - -			\$ 28,200

Equipment for physiology research:

Bioclimatic cabinets	2 @ \$1700 ea.	- - - - -	\$ 3,400
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Miscellaneous rearing equipment:

Small cages	100 @ \$ 10 ea.	- - - - -	\$ 1,000
Larva sifters	4 @ \$ 75 ea.	- - - - -	300
Larva-pupa separators	4 @ \$100 ea.	- - - - -	<u>400</u>
Total - - - - -			\$ 1,700

GRAND TOTAL - - - - - \$108,300

AREA OFFICE
WESLACO, TEXAS

XXXX
UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
~~ENTOMOLOGICAL RESEARCH DIVISION~~
PEE DEE EXPERIMENT STATION
P. O. BOX 271
FLORENCE, SOUTH CAROLINA 29501

27 AUG 1973

August 22, 1973

Subject: Nutritional Experiments With the Screwworm Fly

To: Dr. R. C. Bushland, Research Leader
Screwworm Research Laboratory
P. O. Box 986, Mission, Texas 78572

Through: H. M. Taft, Research Leader
SE Cotton Insects Investigations

Summer activities are almost over and I feel we should begin to plan and make a tentative schedule for the subject experiments.

In the next few weeks I hope to send you and Dr. Gingrich a summary of my thoughts about some factors which might play a role in the color and robust appearance of wild adult flies. The ideas from the three of us, the amino acid data and suggestions from the literature should give us a good selection of variables for testing. We need to establish some specific idea of the nutrients and chemicals that will be tested so they can be ordered and be available when we are ready to begin the experiments.

Have you received any of the amino acid data from Mr. James Cavin? I have some preliminary data from the flies which you sent. There is a lipid in the extract from sheep-reared flies that is absent from the media-reared flies. I don't know what it is or its significance. I will attempt to identify it and also determine fatty acids and triglycerides in the various larvae and adults. Acid and alkaline hydrolysis destroys the color in the cuticle of the flies which suggests that pigments produce the color. I plan to make some more tests on this. If the color is due to pigments then the difference in color between animal- and medium-reared flies may be due to differences in the availability of certain amino acids. I plan to have more definite data in the immediate future.

I am thinking of a date around Oct. 15, 1973 for the start of these studies. A week earlier or later would be equally acceptable. This should give us time to complete the studies before the end of the year. The first day would be well spent if Dr. Gingrich, yourself, and any others that would be participating in the experiments could meet and discuss what is to be done, where, the technical assistance that will be necessary, and other pertinent matters. Thus, the best time for me to come will depend somewhat on Dr. Gingrich's schedule

2.

and that of the personnel at Mission. Perhaps Dr. Gingrich can let you know his schedule and you can determine the most suitable time for the personnel at Mission and let me know the time you have selected.

I am assuming that funds have been provided your laboratory for my travel and per diem. Please let me know how you wish this to be handled. The lodging at Sheraton-Fairway in March was fine and will be suitable again if you feel this is the best arrangement. I could drive my personal car to Mission if it would be useful. Then it would not be necessary for you to furnish me transportation between the motel and the laboratory at Mission. I could also bring in the car some miscellaneous items that would not be convenient to bring on a plane. These items would be selected for their possible usefulness in the experiments. They may or may not be needed but in any case would not be taken on a plane. I'd appreciate knowing your feeling about the transportation. Per diem and mileage would probably equal air fare so the chief advantage would be those things that could be brought in the car and transportation during the time I am in Texas.

Your comments on the above will be appreciated.

Ray Moore

R. F. Moore, Jr.
Research Entomologist

cc:

W. Klassen
W. M. Bruce
H C Cox
R. E. Gingrich

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W. H. Rouse

W. H. Rouse, Jr.
Research Laboratories

cc -
H. Kinsman
H. H. Brown
H. C. Lee
H. H. Kinsman

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2.

and that of the personnel at Mission. Perhaps Dr. Gingrich can let you know his schedule and you can determine the most suitable time for the personnel at Mission and let me know the time you have selected.

I am assuming that funds have been provided your laboratory for my travel and per diem. Please let me know how you wish this to be handled. The lodging at Sheraton-Fairway in March was fine and will be suitable again if you feel this is the best arrangement. I could drive my personal car to Mission if it would be useful. Then it would not be necessary for you to furnish me transportation between the motel and the laboratory at Mission. I could also bring in the car some miscellaneous items that would not be convenient to bring on a plane. These items would be selected for their possible usefulness in the experiments. They may or may not be needed but in any case would not be taken on a plane. I'd appreciate knowing your feeling about the transportation. Per diem and mileage would probably equal air fare so the chief advantage would be those things that could be brought in the car and transportation during the time I am in Texas.

Your comments on the above will be appreciated.

Ray Moore

R. F. Moore, Jr.
Research Entomologist

cc:

W. Klassen
W. M. Bruce
H C Cox
R. E. Gingrich

and that is the purpose of this letter. Perhaps Dr. Glagolev can let
you know his schedule and you can determine the most suitable time
for the interview at Moscow and let us know the time you have
selected.

I am assuming that Jones have been provided your laboratory for my
travel and for other. Please let us know how you wish this to be
handled. The looking at the station-travel in which was time and will
be suitable again if you find this is the best arrangement. I would
drive my personal car to Moscow if it would be useful. Then it would
not be necessary for you to furnish me transportation between the hotel
and the laboratory at Moscow. I could also bring in the car some
of my instruments. Items that would not be convenient to bring on a plane.
These items would be selected for their possible usefulness in the
experiments. They may or may not be needed but in any case would not
be taken on a plane. I'd appreciate knowing your feeling about the
transportation. For time and mileage would probably work out all right
so the chief advantage would be those things that would be brought in
the car and transportation during the time I am in town.

Your comments on the above will be appreciated.

W. F. Hoove, Jr.
Research Scientist

cc:
W. F. Hoove
W. F. Hoove
W. F. Hoove
W. F. Hoove

Screwworm Research Laboratory
P. O. Box 986
Mission, Texas 78572

August 23, 1973

Subject: Screwworm Sounds

To: J. C. Webb, Agriculture Engineer
H. R. Agee, Research Entomologist
U. S. Department of Agriculture
Agricultural Research Service
Gainesville, Florida 32604

Thank you both for the most interesting information you gave over the telephone on August 17 and confirmed by your joint letter of August 20.

I referred copies of the letter to Mr. E. A. Taylor, ARS Area Director; Dr. M. E. Meadows, Director of the APHIS Screwworm Eradication Program at Mission; and to Dr. Donald Williams, Chief Staff Officer, Screwworm Eradication at Hyattsville. I also discussed your data with them and all are most interested.

I am elated at the progress you made in the preliminary experiments and hope you will continue with your laboratory studies while further funding is being investigated. Dr. Hoffman of APHIS at Mission tells me that he is making regular weekly shipments of sterilized pupae to Dr. Mayer. If the numbers being sent are not adequate for both pheromone and sound studies, please telephone and I will arrange for an immediate increase in test insects.

R. C. Bushland
Research Leader

cc: E. A. Taylor
M. E. Meadows
D. L. Williams

U.S. DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C. 20250
August 18, 1955

Mr. J. B. Moore, Director, Bureau of Plant Industry

U.S. Department of Agriculture
Washington, D.C. 20250
Dear Mr. Moore:

I am very glad to hear that you have received the information regarding the results of the survey of the citrus industry in the State of California.

I am also glad to hear that you have received the information regarding the results of the survey of the citrus industry in the State of California. I am also glad to hear that you have received the information regarding the results of the survey of the citrus industry in the State of California.

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Very truly yours,
J. B. Moore

Enclosure
J. B. Moore
Director, Bureau of Plant Industry
U.S. Department of Agriculture
Washington, D.C. 20250

Screwworm Research Laboratory
P. O. Box 986
Mission, Texas 78572

August 23, 1973

Subject: Screwworm Sounds

To: J. C. Webb, Agriculture Engineer
H. R. Agee, Research Entomologist
U. S. Department of Agriculture
Agricultural Research Service
Gainesville, Florida 32604

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R. C. Bushland
Research Leader

cc: E. A. Taylor
M. E. Meadows
D. E. Williams

Screwworm Research Laboratory
P. O. Box 286
Mission, Texas 78272

August 23, 1973

Subject: Screwworm Bionds

To: J. C. Webb, Agricultural Engineer
H. R. Ages, Research Entomologist
U. S. Department of Agriculture
Agricultural Research Service
Gainesville, Florida 32604

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I am elated at the progress you made in the preliminary experiments and hope you will continue with your laboratory studies while further funding is being investigated. Dr. Hoffman of APHIS at Mission tells me that he is making regular weekly shipments of sterilized pupae to Dr. Meyer. If the numbers being sent are not adequate for both pheromone and sound studies, please telephone and I will arrange for an immediate increase in test insects.

R. C. Bushland
Research Leader

cc: E. A. Taylor
M. E. Meadows
D. E. Williams

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
SOUTHERN REGION
1700 S. W. 13th DRIVE
P. O. BOX 14565
GAINESVILLE, FLORIDA 32604

22 AUG 1973

August 20, 1973

Dr. R. C. Bushland
Research Entomologist Leader
Screwworm Research Laboratory
P. O. Box 986 (Moore Air Base)
Mission, Texas 78572

Dear Dr. Bushland:

The premating sound of the sterile screwworm flies were recorded and analyzed. These sounds were then reproduced to both the males and females. The results of these tests follow:

Radiation sterilized flies 1-2 days old were separated according to sex and held in holding cages with water and honey in darkness until used. One batch of flies were four days old and the other batch was 5-6 days old when recordings of flight and premating sounds were made and behavior observations were noted.

Cages of flies were prepared as follows:

Number and sex/cage	Age-days	Response of caged flies to replayed flight and premating sounds
20 males + 20 females	5-6 days	Male activity level increased when premating sounds replayed (most active group of flies) mating attempts increased. No increase in activity in response to replay of flight sounds.
20 males + 20 females	4	Male activity level increased and mating attempts increased. (Not as active as older group.) No response to flight sounds.
20 males	5-6	Male activity level increased and mating attempts made with other males and with dead flies in the cage when premating sounds replayed. No response to flight sounds.
20 female	5-6 days	No reaction to recording of premating or flight sounds.

Observations

1. Females make the premating sound (buzz) by operating the wings scissor-like in very short strokes over the abdomen. The female starts producing the sound just before being mounted by a male and while mating is being attempted by the male. The sound appears to be a cue of other males nearby to make mating attempts with other flies (suitable subjects are females, males and dead flies). When the female makes the premating sound several males in a cage will make an instant attempt to mate.
2. When males and females (virgin) (5-6 days old) are introduced into a cage, about 25% of the males attempt to mate with females. This high level of activity declined to occasional attempts to mate after 1 hour.
3. Four-day-old males are not as active as 5-6 day-old males or as responsive to premating sounds of the females.

Sounds produced

The flight sounds as well as the premating sounds were recorded and analyzed. The waveforms of the flight sounds are shown in Figure 1A and the frequency analysis is shown in Figure 2A. The waveform of the premating sound is shown in Figure 1B and its analysis is shown in Figure 2B. These waveforms and analyses represent only a very limited amount of data but it does show that two entirely different forms of information is present. The major frequency of the flight sound occurs between 200 and 900 Hz, whereas, three major frequency ranges occur in the premating sounds, 1, 3, and 7.5 kHz. This suggests that the premating sound is a specialized sound used for a specific purpose.

Conclusions

This preliminary study suggests that the male fly is stimulated to activity and is attracted to fly-like objects within its visual and acoustic fields. (Odors may be important, but visual and acoustic stimuli appear to be the most important stimuli under the test conditions.)

An estimate of the funds needed for a one-year study of the sounds produced by the screwworm fly is included. This study would attempt to answer the following questions:

1. What sound frequencies stimulate males to increased activity and mating attempts?
2. What is the optimum sound pressure level for initiating the male response to premating sounds?

3. What is the optimum age for males to respond to premating sounds of females?
4. What is the maximum distance that a male fly can be induced to activity and mating attempts by premating sounds?
5. Will male flies be stimulated by electronic stimulations of female fly premating sounds?
6. What percent of male flies within the acoustic field of premating sounds are stimulated to activity by the sound?
7. Do the male flies habituate to prepritive production of premating sounds?
8. Will recorded and replayed premating sounds attract wild and reared males in the field?
9. To isolate and identify these premating sounds.

Cost estimate

	<u>Engineering</u>	<u>Behavior</u>
Professional time	\$ 5,000	\$ 5,000
Extramural funds for technical assistance	5,000	5,000
Electronic equipment	15,000	2,000
Other supplies	2,000	1,000
Travel	1,000	1,000
Total	\$28,000 18,000	\$16,000 4,500

Sincerely,

J. C. Webb

J. C. Webb
Agriculture Engineer

Harold R. Agee

H. R. Agee
Research Entomologist

cc:

D. F. Davis

D. L. Chambers

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
SOUTHERN REGION
1700 S. W. 13th DRIVE
P. O. BOX 14365
GAINESVILLE, FLORIDA 32604

22 AUG 1973

August 20, 1973

Dr. R. C. Bushland
Research Entomologist Leader
Screwworm Research Laboratory
P. O. Box 986 (Moore Air Base)
Mission, Texas 78572

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20 female	5-6 days	No reaction to recording of premating or flight sounds.

Observations

1. Females make the pre-mating sound (buzz) by operating the wings scissor-like in very short strokes over the abdomen. The female starts producing the sound just before being mounted by a male and while mating is being attempted by the male. The sound appears to be a cue of other males nearby to make mating attempts with other flies (suitable subjects are females, males and dead flies). When the female makes the pre-mating sound several males in a cage will make an instant attempt to mate.
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Conclusions

This preliminary study suggests that the male fly is stimulated to activity and is attracted to fly-like objects within its visual and acoustic fields. (Odors may be important, but visual and acoustic stimuli appear to be the most important stimuli under the test conditions.)

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2. What is the optimum sound pressure level for initiating the male response to pre-mating sounds?

3. What is the optimum age for males to respond to premating sounds of females?
4. What is the maximum distance that a male fly can be induced to activity and mating attempts by premating sounds?
5. Will male flies be stimulated by electronic stimulations of female fly premating sounds?
6. What percent of male flies within the acoustic field of premating sounds are stimulated to activity by the sound?
7. Do the male flies habituate to repetitive production of premating sounds?
8. Will recorded and replayed premating sounds attract wild and reared males in the field?
9. To isolate and identify these premating sounds.

Cost estimate

	<u>Engineering</u>	<u>Behavior</u>
Professional time	\$ 5,000	\$ 5,000
Extramural funds for technical assistance	5,000	5,000
Electronic equipment	15,000	2,000
Other supplies	2,000	1,000
Travel	1,000	1,000
Total	\$28,000	\$14,000

Sincerely,

J. C. Webb

J. C. Webb
Agriculture Engineer

Harold R. Agee

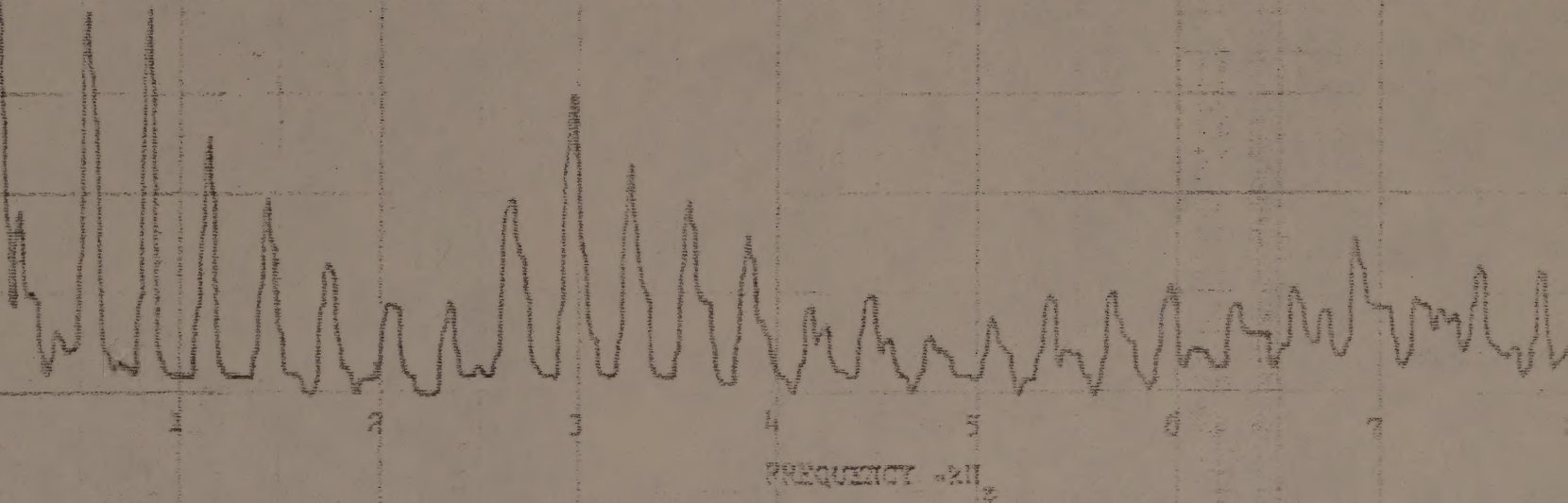
H. R. Agee
Research Entomologist

cc:

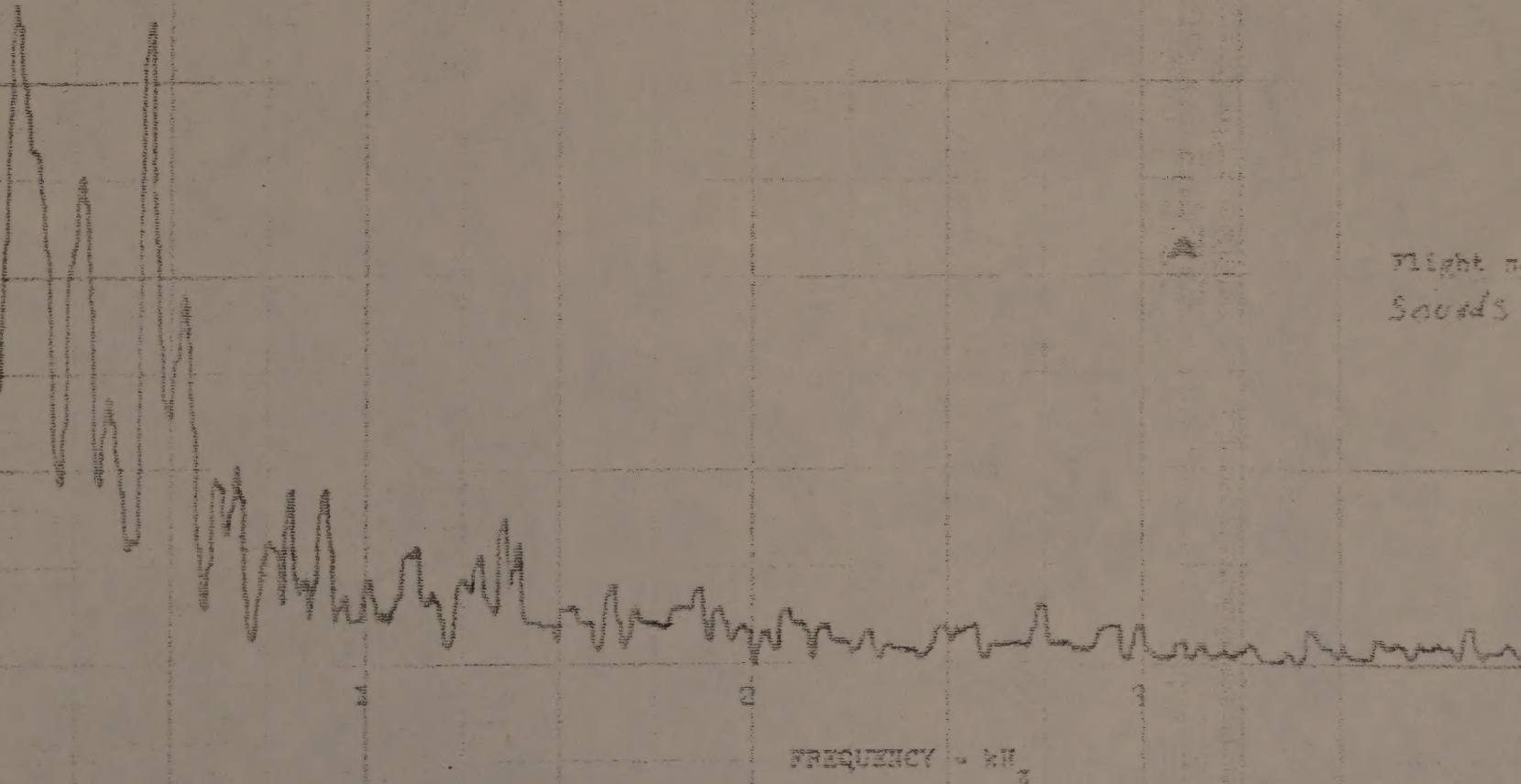
D. F. Davis
D. L. Chambers

FREQUENCY SPECTRUM OF SCREWDRIVER FLY SOUND

Premating
Sounds



Flight
Sounds



Screwworm Research Laboratory
P. O. Box 986
Mission, Texas 78572

August 28, 1973

Subject: Collection of Screwworm Egg Masses

To: E. A. Taylor, Area Director
Subtropical Texas Area

Through: R. C. Bushland, Research Leader

Screwworm populations in southern Texas have continued to increase during the last few weeks. In assessing the effectiveness of the released sterile males, we find data on the frequency of sterile egg masses in nature very helpful. Last week, Dr. Bushland suggested that I go into the area of screwworm outbreaks and collect data.

The techniques I used were the same as those employed last fall. I made an appointment with a rancher who had screwworm-infested cattle and planned to treat them. I was there during the process to remove egg masses from the wounds and then determine whether they were fertile or sterile by holding them in a favorable environment during the normal incubation period.

On August 22 and the morning of August 23, 1973, I was on the Alta Colorado Ranch about 13 miles west of Rachel, Brooks County, Texas. (Rachel is located on US 281, 24 miles south of Falfurrias.) Five groups of cows and calves (200-300 lbs.) had been corralled for the purpose of treating screwworms. The data obtained are summarized as follows:

Cattle examined	364
Screwworm cases	99
Egg masses:	
Sterile	8
Fertile	20

All the screwworm cases except one were in the ears of cows and calves, mostly the latter. One eye of a cow was infested. Gulf Coast ticks were abundant on the ears of the cattle and were surely responsible for most of the infestations.

Calvin M. Jones
Research Entomologist

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AUG 30 1973

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WESLACO, TEXAS

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JAN 30 1973

Screwworm Research Laboratory
P. O. Box 986
Mission, Texas 78572

August 28, 1973

Subject: Collection of Screwworm Egg Masses

To: E. A. Taylor, Area Director
Subtropical Texas Area

Through: R. C. Bushland, Research Leader

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The techniques I used were the same as those employed last fall. I made an appointment with a rancher who had screwworm-infested cattle and planned to treat them. I was there during the process to remove egg masses from the wounds and then determine whether they were fertile or sterile by holding them in a favorable environment during the normal incubation period.

On August 22 and the morning of August 23, 1973, I was on the Alta Colorado Ranch about 13 miles west of Rachel, Brooks County, Texas. (Rachel is located on US 281, 24 miles south of Falfurrias.) Five groups of cows and calves (200-300 lbs.) had been corralled for the purpose of treating screwworms. The data obtained are summarized as follows:

Cattle examined	364
Screwworm cases	99
Egg masses:	
Sterile	8
Fertile	20

All the screwworm cases except one were in the ears of cows and calves, mostly the latter. One eye of a cow was infested. Gulf Coast ticks were abundant on the ears of the cattle and were surely responsible for most of the infestations.

Calvin M. Jones
Research Entomologist

RECEIVED

AUG 30 1973

AREA OFFICE
WESLACO, TEXAS

Scireworm Research Laboratory
P. O. Box 986
Mission, Texas 78272

August 28, 1973

Subject: Collection of Scireworm Egg Masses

To: M. A. Taylor, Area Director
Subtropical Texas Area

Through: R. C. Bushland, Research Leader

Scireworm populations in southern Texas have continued to increase during the last few weeks. In assessing the effectiveness of the released sterile males, we find data on the frequency of sterile egg masses in nature very helpful. Last week, Dr. Bushland suggested that I go into the area of scireworm outbreaks and collect data.

The techniques I used were the same as those employed last fall. I made an appointment with a rancher who had scireworm-infested cattle and planned to treat them. I was there during the process to remove egg masses from the wounds and then determine whether they were fertile or sterile by holding them in a favorable environment during the normal incubation period.

On August 22 and the morning of August 23, 1973, I was on the Alta Colorado Ranch about 12 miles west of Rachel, Brooks County, Texas. (Rachel is located on US 281, 24 miles south of Dalhart.) Five groups of cows and calves (200-300 lbs.) had been corralled for the purpose of treating scireworms. The data obtained are summarized as follows:

Cattle examined	364
Scireworm cases	29
Egg masses:	
Sterile	8
Fertile	20

All the scireworm cases, except one were in the ears of cows and calves, mostly the latter. One eye of a cow was infested. Gulf Coast ticks were abundant on the ears of the cattle and were surely responsible for most of the infestations.

Calvin M. Jones
Research Entomologist

RECEIVED

AUG 30 1973

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE

SOUTHERN REGION
Screwworm Research Laboratory
P. O. Box 986
Mission, Texas 78572

August 28, 1973

Subject: Collection of Screwworm Egg Masses

To: E. A. Taylor, Area Director
Subtropical Texas Area

Through: R. C. Bushland, Research Leader *B*

Screwworm populations in southern Texas have continued to increase during the last few weeks. In assessing the effectiveness of the released sterile males, we find data on the frequency of sterile egg masses in nature very helpful. Last week, Dr. Bushland suggested that I go into the area of screwworm outbreaks and collect data.

The techniques I used were the same as those employed last fall. I made an appointment with a rancher who had screwworm-infested cattle and planned to treat them. I was there during the process to remove egg masses from the wounds and then determine whether they were fertile or sterile by holding them in a favorable environment during the normal incubation period.

On August 22 and the morning of August 23, 1973, I was on the Alta Colorado Ranch about 13 miles west of Rachal, Brooks County, Texas. (Rachal is located on US 281, 24 miles south of Falfurrias.) Five groups of cows and calves (200-300 lbs.) had been corralled for the purpose of treating screwworms. The data obtained are summarized as follows:

Cattle examined	364
Screwworm cases	99
Egg masses:	
Sterile	8
Fertile	20

All the screwworm cases except one were in the ears of cows and calves, mostly the latter. One eye of a cow was infested. Gulf Coast ticks were abundant on the ears of the cattle and were surely responsible for most of the infestations.

Calvin M. Jones
Calvin M. Jones
Research Entomologist

ENDORSEMENT:

Screwworm situation in Texas is not good. Jones has been busy in Mexico. This is his first collection in Texas this year.

*Please circulate to E.F. Kringling and
T. Henderson*

E.A. Taylor

RECEIVED

AUG 30 1973

AREA OFFICE
WESLACO, TEXAS

EAT
*Sent Telecopier
Dr. C. 8/30/73*
*Sent 8/31/73
Telecopier to
Dr. Klauer*

UNITED STATES DEPARTMENT OF AGRICULTURE
 AGRICULTURAL RESEARCH SERVICE
 STEVENSON RESEARCH LABORATORY
 P. O. BOX 986
 MISSION, TEXAS 78271

August 28, 1973

Subject: Collection of ScREWworm Egg Masses

To: E. A. Taylor, Area Director
 Entomological Texas Area

Through: R. C. Marshall, Research Leader

ScREWworm populations in southern Texas have continued to increase during the last few weeks. In assessing the effectiveness of the released sterile males, we find data on the frequency of sterility suggest an increase in sterile frequency. Last week, Dr. Marshall suggested that I go into the area of extensive outbreaks and collect data.

The conditions I used were the same as those employed last fall. I made an appointment with a rancher who had extensive infested cattle and planned to treat them. I was there during the process to remove egg masses from the females and then determine whether they were fertile or sterile by holding them in a sterility environment during the normal incubation period.

On August 22 and the morning of August 23, 1973, I was on the Alta Colorado Ranch about 15 miles west of Rachel, Brooks County, Texas. (Rachel is located on US 381, 20 miles north of Dalhart.) Five groups of cows and calves (500-600 lbs.) had been corralled for the purpose of treating screwworm. The data obtained are summarized as follows:

300	Cattle examined
97	ScREWworm eggs
	ScREW masses:
8	sterile
20	fertile

All the screwworm measurements one mile in the area of cows and calves, mostly the latter. One eye of a cow was infested. Gulf Coast ticks were abundant on the area of the cattle and were mainly responsible for most of the infestations.

Calvin M. Jones
 Research Entomologist

ENCLOSURE:

ScREWworm situation in Texas is not good. Jones has been busy in Mexico. This is his first collection in Texas this year.

RECEIVED

eat
OK

Screwworm Research Laboratory
P.O. Box 986
Mission, Texas 78572

August 28, 1973

Subject: Nutritional Experiments with the Screwworm Fly

To: R. F. Moore, Jr., Research Entomologist
SE Cotton Insects Investigations

Through: H. M. Taft, Research Leader
SE Cotton Insects Investigations

Thank you for your letter of August 22 proposing that you begin your month's temporary duty at this laboratory approximately October 15. I will be away from the laboratory October 15 through October 23, so suggest that you come either the week before my departure or any time you wish after October 23.

The most important factor is that your trip be coordinated with Dr. Gingrich so that he can work with you at the beginning of your experiments.

The texture soy protein and letter of transmittal came last week. I delivered both to Mr. A. J. Graham of APHIS. He will conduct a preliminary trial. Earlier he tested some soy flour with encouraging results as far as larval growth is concerned.

These soy products may be too expensive. The material you sent was priced at 30 to 60 cents a pound. If 60 cents is the more realistic figure, then the rehydrated product simulating meat after taking up 3 parts of water would cost 15 cents per pound. The screwworm program bought frozen nutria for 11 cents a pound last year. It will probably be higher this year, and the supply is not adequate so there is good reason to consider soy protein.

We did not get any amino acid data from Mr. Cavin, so you may want to check with him again before you come here.

As far as I am concerned, it will be fine for you to come in your car and collect mileage. I am referring your letter and this reply to the Area Director, Mr. E. A. Taylor, who controls our finances. Unless he notifies me to the contrary, I'll assume that we can pay your travel for approximately one month here this fall.

R. C. Bushland
Research Leader

✓ CC: E. A. Taylor

RECEIVED

AUG 29 1973

AREA OFFICE
WESLACO, TEXAS

Screwworm Research Laboratory
P.O. Box 986
Mission, Texas 78572

August 28, 1973

Subject: Nutritional Experiments with the Screwworm Fly

To: R. V. Moore, Jr., Research Entomologist
SE Cotton Insects Investigations

Through: H. M. Taft, Research Leader
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We did not get any amino acid data from Mr. Gavin, so you may want to check with him again before you come here.

As far as I am concerned, it will be fine for you to come in your car and collect mileage. I am returning your letter and this reply to the Area Director, Mr. R. A. Taylor, who controls our finances. Unless he notifies me to the contrary, I'll assume that we can pay your travel for approximately one month here this fall.

R. C. Bushland
Research Leader

CC: R. A. Taylor

RECEIVED

AUG 29 1973

AREA OFFICE

Research / Screw Worm - Gen. Solder
eat

Screwworm Research Laboratory
P.O. Box 986
Mission, Texas 78572

August 28, 1973

Subject: Nutritional Experiments with the Screwworm Fly

To: R. F. Moore, Jr., Research Entomologist
SE Cotton Insects Investigations

Through: H. M. Taft, Research Leader
SE Cotton Insects Investigations

Thank you for your letter of August 22 proposing that you begin your month's temporary duty at this laboratory approximately October 15. I will be away from the laboratory October 15 through October 23, so suggest that you come either the week before my departure or any time you wish after October 23.

The most important factor is that your trip be coordinated with Dr. Gingrich so that he can work with you at the beginning of your experiments.

The texture soy protein and letter of transmittal came last week. I delivered both to Mr. A. J. Graham of APHIS. He will conduct a preliminary trial. Earlier he tested some soy flour with encouraging results as far as larval growth is concerned.

These soy products may be too expensive. The material you sent was priced at 30 to 60 cents a pound. If 60 cents is the more realistic figure, then the rehydrated product simulating meat after taking up 3 parts of water would cost 15 cents per pound. The screwworm program bought frozen nutria for 11 cents a pound last year. It will probably be higher this year, and the supply is not adequate so there is good reason to consider soy protein.

We did not get any amino acid data from Mr. Cavin, so you may want to check with him again before you come here.

As far as I am concerned, it will be fine for you to come in your car and collect mileage. I am referring your letter and this reply to the Area Director, Mr. E. A. Taylor, who controls our finances. Unless he notifies me to the contrary, I'll assume that we can pay your travel for approximately one month here this fall.

R. C. Bushland
Research Leader

CC: E. A. Taylor

RECEIVED

AUG 30 1973

AREA OFFICE
WESLACO, TEXAS

eat

Scireworm Research Laboratory
P.O. Box 986
Mission, Texas 78272

August 28, 1973

Subject: Nutritional Experiments with the Scireworm Fly

To: R. F. Moore, Jr., Research Entomologist
SE Cotton Insect Investigations

Through: H. M. Telf, Research Leader
SE Cotton Insect Investigations

Thank you for your letter of August 22 proposing that you begin your month's temporary duty at this laboratory approximately October 15. I will be away from the laboratory October 15 through October 23, so suggest that you come either the week before my departure or any time you wish after October 23.

The most important factor is that your trip be coordinated with Dr. Gillingham so that he can work with you at the beginning of your experiments.

The texture soy protein and letter of transmittal came last week. I delivered both to Mr. A. J. Graham of ARS. He will conduct a preliminary trial. Earlier he tested some soy flour with encouraging results as far as larval growth is concerned.

These soy products may be too expensive. The material you sent was priced at 30 to 60 cents a pound. If 60 cents is the more realistic figure, then the rehydrated product stimulating most after taking up 3 parts of water would cost 15 cents per pound. The scireworm program bought frozen nuclei for 11 cents a pound last year. It will probably be higher this year, and the supply is not adequate so there is good reason to consider soy protein.

We did not get any amino acid data from Mr. Gavin, so you may want to check with him again before you come here.

As far as I am concerned, it will be fine for you to come in your car and collect mileage. I am referring your letter and this reply to the Area Director, Mr. E. A. Taylor, who controls our finances. Unless he notifies me to the contrary, I'll assume that we can pay your travel for approximately one month here this fall.

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AUG 30 1973

AREA OFFICE
WESTLACO, TEXAS

R. C. Bushland
Research Leader

CC: E. A. Taylor

17 SEP 1973
B
UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL RESEARCH SERVICE

~~ENTOMOLOGICAL RESEARCH DIVISION~~

PEE DEE EXPERIMENT STATION

P. O. BOX 271

FLORENCE, SOUTH CAROLINA 29501

FILE: SECTION Research
SUBJECT Screwworm
FOLDER New Correspond.

September 10, 1973

Subject: Nutritional Experiments on Screwworm Flies

To: R. C. Bushland, Laboratory for Screwworm Research
Mission, TexasThrough: H. M. Taft, Research Leader *HT*
Southeastern Cotton Insects Investigations

As we have agreed, the objectives of the subject experiments are to obtain from media, adult flies that have the blue color and the robust appearance of flies reared in an animal and hopefully this will result in a "normal" fully competitive fly.

I propose that the primary approach to these objectives be based on the premise that the flies reared on media get insufficient amino acids from their diets. The premise is suggested by the following. First, I recall that you did not remember any media-reared flies looking like animal-reared flies, even on the very best media and under the best conditions. Conditions in a living tissue are very different from those in dead tissue and an unknown factor related to this may be the basis for the differences in the flies. However, in all the diets which I have seen, plasma or blood is only 5-30% of the liquid in the diet. My impression is that in the living animal, the larvae are in the flesh and bathed in lymph or plasma. This seems significant because published values for the amino acid composition of beef muscle and blood plasma show that the plasma contains higher percentages of cystine, leucine, phenylalanine, tryptophan, tyrosine and valine. The plasma contains approximately 7% protein which is diluted by at least one-third in most diets. Dick Gingrich showed that cystine, leucine, phenylalanine, tryptophan and valine are among the amino acids required by the screwworm. Thus, there is a possibility that dilution of the plasma results in the media being deficient in the amino acids mentioned above.

It is my impression that the robust appearance of the fly is related to the wideness of the thorax. The only thing which I have found that is related to this is the finding of S. D. Beck that the head capsule was narrow in the larvae of the European corn borer when reared on diets that were deficient in protein or carbohydrate. This is suggestive of a role for amino acids in the robust appearance of the screwworm.

Color in insects may be due to the physical characteristics of the exoskeleton or to pigments. Some simple tests that I have done on the screwworm suggest that both of these contribute to the color of the fly. The

2.

bluish-green color of the adult changes to a golden brown in 10% sodium hydroxide and to a greenish-yellow in 6 N HCl. Changing from acid to alkaline will reverse the colors and this can be repeated several times on the same piece of exoskeleton. This is suggestive of pigments. When the golden brown cuticle in alkaline solution is rotated to a particular angle, a blue color can be seen and this suggests a physical factor. A recent review of pigments (Fuzeau-LBraesch, 1972, Ann. Rev. Ent. 17:403) indicates that tryptophan, cystine, methionine and tyrosine are involved in pigment formation. Another article implicates phenylalanine. It is possible that all of these except methionine are deficient in the media. Bile pigments are also involved in color in some insects and it is possible that such pigments in whole dried blood may be affecting the color of the flies.

Thus, there is evidence for the possible deficiency of certain amino acids in the media and there are indications that the difference in color and appearance of the flies could be caused by such a deficiency.

An experiment using undiluted plasma as the liquid in a meat diet should be done if it has not already been tried. A parallel experiment to develop an artificial plasma is suggested. This should be based on 6-7% egg albumin plus any amino acids necessary to adjust it to a composition similar to that of plasma. The plasma would be made isotonic with Wesson salt mixture plus CoCl_2 , Zn-acetate and Na molybdate. Cholesterol and vitamins would also be added. This artificial plasma could be substituted for the blood plasma in a meat media. If these diets are successful in producing a "normal" fly, then the artificial plasma could serve as a basis for determining which amino acids were responsible for the color differences and the robust appearance and could possibly serve as a means of evaluating proteins for use in other diets.

Do you think it would be wise to devise a color measurement test so that there would be some objective means of determining how closely the color of the media flies resembles that of animal reared? Would measurement of the length and width of the thorax or the resulting ratio give a valid measure of the robustness of the flies?

I hope that you and Dick Gingrich will be critical of these proposals and point out deficiencies in information or errors in reasoning.

The amino acids, vitamins, etc. will be ordered here and I will bring them with me when I come to Texas.

R. F. Moore, Jr.

R. F. Moore, Jr.
Research Entomologist

cc:
Dick Gingrich
W. Klassen

Screwworm Research Laboratory
Post Office Box 986
Mission, Texas 78572

SECTION
SUBJECT
FOLDER

Research
Screwworm
Gen. Consp.

September 11, 1973

Subject: Screwworm Situation

To: Dr. Lyman S. Henderson
National Program Staff
USDA, Agricultural Research Service
Hyattsville, Maryland 20782

Mr. Taylor suggested that I write you regarding my schedule for the Washington meeting and briefly inform you of the current screwworm situation in South Texas.

I will fly to Baltimore with Dr. M. E. Meadows on Sunday. Dr. Williams of APHIS has made a reservation for us at the Quality Courts in Hyattsville. He said that on Monday morning he would take us to Washington for the meeting at Dr. Mulhern's office. Dr. Meadows, Dr. Williams and I will leave Washington at 9:00 P.M. Monday, flying via Miami to San Juan, arriving there at 3:00 A.M. Tuesday. At 8:00 A.M., we are to attend a screwworm meeting at the Roosevelt Roads Naval Base. Wednesday, Thursday, and Friday we'll spend in field studies, and I'll fly back to Texas on Saturday.

Screwworms are continuing to increase in South Texas with most of the infestations in ears of cattle in wounds initiated by Gulf Coast ticks. With the help of APHIS inspectors, we have been collecting egg masses from naturally infested cattle in this area. Since August 22, Calvin Jones has checked hatching records on a total of 139 egg masses from four counties. Of these, 114 hatched and 25 were sterile for an average of only 18 percent sterility.

Our only hope for control in this region this fall is that the new Tex-Mex strain will be competitive. Field releases over a 2000 square mile area south of Corpus Christi will begin September 19. APHIS will disperse 4 million Tex-Mex flies weekly in this area. Sterility data will be compared on egg masses collected within the special treatment area and outside the area where regular APHIS production flies will be released at the same rate of 2000 per square mile per week. This test is being planned and executed as a joint APHIS-ARS field trial.

R. C. Bushland
Research Leader

cc: */* E. A. Taylor
M. E. Meadows

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SEP 13 1973

AREA OFFICE
WESLACO, TEXAS

RECEIVED

SEP 13 1973

AREA OFFICE
WESLACO, TEXAS

R. C. Bushland
Research Leader

cc: E. A. Taylor
M. E. Meadows

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To: Dr. Lyman S. Henderson
National Program Staff
USDA, Agricultural Research Service
Huntsville, Maryland 20782

Subject: Screwworm Situation

September 11, 1973

Screwworm Research Laboratory
Post Office Box 986
Mission, Texas 78272

SECTION
SUBJECT
FOLDER

SECTION Research
SUBJECT Agriculture
FOLDER New Corrope

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
METABOLISM AND RADIATION RESEARCH LABORATORY

STATE UNIVERSITY STATION
FARGO, NORTH DAKOTA 58102

20 SEP 1973

eat

September 18, 1973

Subject: Exploratory Investigations on Radar Tracking of Screw-worm Flies

To: Dr. R. C. Bushland, Director,
Screw-worm Research Laboratory
Mission, Texas 78572

Attached is a summary report of my activities at Los Alamos Scientific Laboratory during the period of Sept. 6-10, 1973. I also sent a copy of this report to Dr. Baldwin at LASL. I feel that Dr. Baldwin is a very competent scientist and would effectively cooperate with ARS and APHIS in developing a radar tracking system. It was somewhat unfortunate that my trip to LASL resulted in no work being done on actual tracking of insects. The equipment that was set up for demonstration was done so to demonstrate the principle of Doppler radar on a rotating wire loop simulating the movement of a fly's wing. The components used in this prototype were not readily portable, and the actual radar module is no longer being manufactured. If LASL were to construct a portable hand-held radar unit, they would have to do so by using another radar module and redesign and construct the remaining components based on predetermined specifications such as range, signal output, etc. ARS or APHIS would then have to provide LASL with the necessary information about the screw-worm fly, i.e., wing beat frequency, etc.

Dr. Baldwin indicated to me that he is interested in continuing the basic work on instrument design and also in field implementation. The importance of this project is of such a nature that in my opinion, the USDA could benefit greatly by proper utilization of Dr. Baldwin's participation on this project.

I realize, of course, through past experience, that APHIS dealings with LASL have not always been fruitful and you are anxious to insure that ARS has an active role in the radar tracking project and that the work is accomplished. At the present time, I can summarize the situation as follows:

- 1) The LASL radar tracking device is in the developmental stage, with Drs. Baldwin and Depp interested in developing a model for field testing.
- 2) Dr. Crystal would have valuable input based on flight mill studies. I would recommend his doing landing studies with metallic markers as well as wing beat frequency studies.
- 3) Dr. Hoffman has the capability to do flight studies of marked insects in the areas of release, thereby eliminating the effects of temperature,

Dr. R. C. Bushland
September 18, 1973
Page 2

altitude, etc. I would recommend that if and when a field test with radar is set up that Dr. Hoffman be involved.

4) In the near future, if LASL is to continue the development work, a further contact should be made with Drs. Baldwin and Depp by the people at the Mission Laboratory. At present, there are too many people in between those who could do the job and those that want it done.

ALTERNATIVES TO LASL INVOLVEMENT

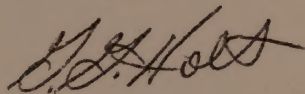
1) The NDSU College of Engineering is interested in developing a radar tracking device applicable to insect studies. They are investigating component and development costs and also writing a grant proposal.

2) MRRL could act in the capacity of a contract officer to NDSU and provide consultation and insects in the event they could develop the tracking system.

3) I contacted Hewlett Packard Co. and obtained the technical information and literature on the radar module used by LASL and passed them on to the NDSU College of Engineering people.

Dr. Nelson will keep you informed of discussions with the NDSU Engineering personnel.

Best regards,



Gerald G. Holt, Research Biologist
Insect Metabolism and Physiology Section

encl. (as stated)

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
METABOLISM AND RADIATION RESEARCH LABORATORY
STATE UNIVERSITY STATION
FARGO, NORTH DAKOTA 58102

September 18, 1973

REPORT OF PRELIMINARY STUDIES OF RADAR TRACKING OF SCREW-WORM FLIES

Note: The following experiments were conducted at IASL during the period of Sept. 6-10, 1973.

MATERIALS

Insects:

Sterilized screw-worm flies were supplied by the APHIS Screw-worm Eradication Plant at Mission, Texas. Sterilized pupae were obtained at the Mission facility on Sept. 5 and transported by commercial airline to IASL on the morning of Sept. 6. Two age groups were used -- group I was to emerge 12 hours after collection and group II was to emerge 24 hours after collection. Test insects were transported as free pupae in ventilated wooden boxes.

Marking Material and Adhesive:

A number of methods were tested in an effort to instrument flies for radar detection. Silver micropaint (SC-13 Microcircuits Co., New Buffalo, Mich.) was applied with the aid of a small, camel's-hair brush to the total dorsal wing surface of one group of flies and just to the leading surface of the wings of another group. A mixture (1:1) of silver micropaint and Eastman 910 adhesive was used to attach a 1-cm-long gold wire to the dorsal surface of the leading edge of the wing. Insects were tethered to a small wire attached to the thorax and suspended from a glass rod to record flight activity. Instrumented flies were placed 20 feet from the Doppler radar unit for testing.

Radar Unit:

The radar component used during testing was a modified Hewlett-Packard X-band Doppler module (35200 series and no longer manufactured) coupled to a Textronix CRO for visual display and to an audio-amplifier.

RESULTS

General Activity of Test Insects:

The temperature at LASL where the experiments were conducted and the cages in which the test insects were contained was held at 68°F. Flight activity was minimal at this temperature. I expressed concern over the general activity of the flies to Dr. Bushland in a telephone conversation from Los Alamos to Mission. He immediately ordered flight dispersal studies at the Mission facility where the daytime temperatures reached 80-90°F. He concluded that the production insects readily dispersed from the containers and that the problems we were encountering at LASL were a result of the environmental conditions and not a behavioral characteristic resulting from laboratory colonization or mass production.

Instrumentation of Flies and Detection:

Flies instrumented with silver paint on the leading surface of the wings were successfully detected by radar during tethered flight. Those flies with the entire wing surface painted were unable to sustain flight. Application of paint with a small spray-gun device may eliminate this problem. It is not known at this time whether the flight capability is altered by paint or glue, nor is the toxicity of these chemicals known. Flies instrumented with small strips of gold wire glued to their wings could maintain flight, but they were not tested because of a malfunction in the radar unit. It was further noted that flies on which foreign substances were placed spent a great deal of time trying to clean themselves rather than flying or crawling within the cages.

FILE: SECTION Research
SUBJECT Screwworm
FOLDER General

→ E. A. Taylor
Weslaco, Texas

Copy to
R. R. Johnston
10-9-73

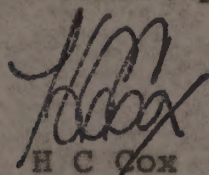
October 3, 1973

Subject: Travel to Mexico for Tick and
Screwworm Research

To: The Record

APHIS has contacted our Kerrville laboratory requesting assistance on screwworm and tick problems. There is an increased incidence of screwworm infestations in wounds on cattle caused by tick feeding. In anticipation of the expanded screwworm suppression program in Mexico, they would like additional information on insecticides that will control ticks and screwworms in wounded cattle. We have considerable laboratory data but research under field conditions where the problems exist is lacking.

Our Kerrville laboratory proposes to send O. H. Graham, William Gladney and Donald Hopkins to Mexico to conduct the necessary experiments. Dr. Graham is already included in the ARS Foreign Travel Plan (line 307). G. W. Eddy and R. R. Grabbe were included in the Foreign Travel Plan for intermittent travel into Mexico in support of research on the screwworm (lines 319 and 320). Inasmuch as Dr. Eddy retired at the end of June and Dr. Grabbe recently resigned from ARS, we believe that Dr. Gladney and Mr. Hopkins should be temporary replacements for Eddy and Grabbe in order to carry out our screwworm and tick research in support of APHIS needs. Graham, Gladney, and Hopkins already have their official passports with visas for intermittent travel into Mexico. In view of the nature of research and the proximity of Kerrville to Mexico, Dr. J. R. Johnston can authorize their travel under the authority contained in AM 103.1.


H C Cox

Associate Deputy Administrator

cc:

E. A. Taylor, Weslaco, Tex.
J. R. Johnston, College Station, Tex.
B&F

RECEIVED

OCT 9 1973

AREA OFFICE
WESLACO, TEXAS

[Handwritten signature]

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Teletypewriter
10/16/73
nc
Cox
Henderson
Knipling

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UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
SOUTHERN REGION
SUBTROPICAL TEXAS AREA
P. O. Box 267
Weslaco, Texas 78596

FILE: SECTION Research
SUBJECT Screw worm
FOLDER Gen Conespd

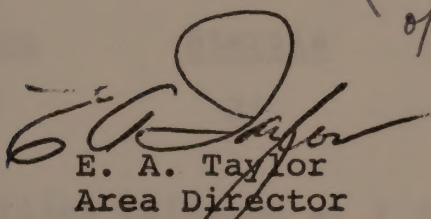
October 15, 1973

Subject: Field Evaluation of New Tex-Mex Strain of
Screwworm

To: H. C. Cox, Associate Deputy Administrator
Southern Region, USDA, ARS
New Orleans, LA 70153

The first week's results of the above test are attached, along with the map of the area. Approximately four million Tex-Mex strain flies are being released each week in a 50 x 40 square-mile area. Four sheep pens and liver bait traps are located on ranches near the center of this area and in the control area (APHIS program flies), at least 15-30 miles west of the Tex-Mex area.

The screwworm population is extremely high in South Texas. Equal number of Tex-Mex and wild flies were caught during the sampling period and only a 2 to 1 overflooding in the adjacent program-released area (APHIS). Preliminary data on egg mass collections from the wounded sheep indicate that the new Tex-Mex strain is approximately 40% as competitive as the wild fly (18.1% sterile egg masses). Similar data from the APHIS check area indicate that the regular APHIS program strain is about 5-10% as competitive as the wild fly (7.7% sterile egg masses).


E. A. Taylor
Area Director

cc:
E. F. Knipling
L. Henderson

ARS:SR:EATaylor:nc 10/16/73

ANS:CR:RAT:101:RG 10/10/73

Field Evaluation of New Tex-Mex Strain
of Screwworm (2,000 sq. mile test area)

Flies Trapped Oct. 3-11

<u>Oct.</u>	<u>Tex-Mex</u>		<u>APHIS</u>	
	<u>ABCD TRAPS</u> (4 Traps)		<u>WXYZ TRAPS</u> (4 Traps)	
	<u>Tame</u>	<u>Wild</u>	<u>Tame</u>	<u>Wild</u>
3	0	6	23	6
4	1	3	8	3
5	5	9	12	4
6	-	-	42	29
11	<u>212</u>	<u>239</u>	<u>103</u>	<u>42</u>
TOTAL	218	257	188	84

Egg Masses Collected Oct. 5-11

<u>4 Sheep Pens</u>			<u>4 Sheep Pens</u>		
<u>Tex-Mex Area</u>			<u>APHIS Check</u>		
<u>Fertile</u>	<u>Sterile</u>	<u>% Sterile</u>	<u>Fertile</u>	<u>Sterile</u>	<u>% Sterile</u>
140	31	18.1%	155	13	7.7%

Flies released at 2,000 sq/mi/we beginning Sept. 20. One release per week.

Release rate will be doubled by twice weekly releases starting Nov. 1.

Final Evaluation of New Two-Max Design
 of Formwork 15,000 sq. ft. in 1961

Final Report Oct. 3-11

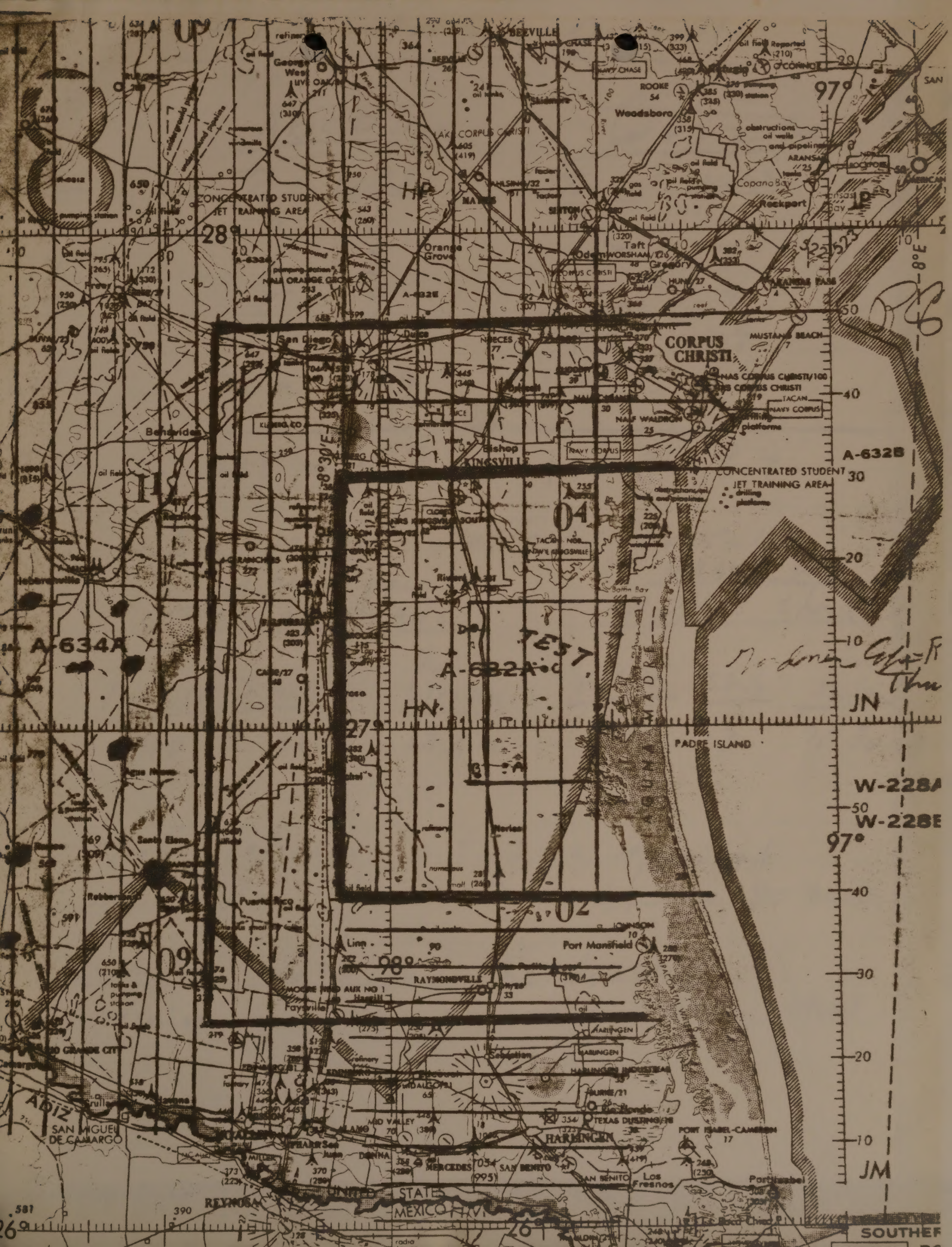
Two-Max		Single	
SQUAD TOTALS		SQUAD TOTALS	
14 Trials		14 Trials	
Time	Weld	Time	Weld
0	8	0	8
1	1	1	8
2	2	2	12
-	-	-	83
175	129	175	108
178	127	178	108

Top Maxes Collected Oct. 3-11

Two-Max Area		Single Area	
Squad		Squad	
14 Trials		14 Trials	
Time	Weld	Time	Weld
140	10.18	140	12
141	11	141	12
142	10.18	142	12
143	10.18	143	12
144	10.18	144	12
145	10.18	145	12
146	10.18	146	12
147	10.18	147	12
148	10.18	148	12
149	10.18	149	12
150	10.18	150	12

Final released at 1,500 sq. ft. beginning Sept. 10. One release
 was made.

Release area will be doubled by twice weekly releases starting



CONCENTRATED STUDENT
JET TRAINING AREA

CORPUS CHRISTI

CONCENTRATED STUDENT
JET TRAINING AREA

A-632A

A-632B

W-228A

W-228E

97°

JM

SOUTHER



Flies trapped Oct 3-11

Tex Mex

ABCD Traps

APHIS

WXYZ Traps

<u>Oct</u>	<u>Time</u>	<u>Wt</u>	<u>Time</u>	<u>Wt</u>
3	0	6	23	6
4	1	3	8	3
5	5	9	12	4
6	—	—	42	29
11	212	239	103	42
Total	218 - 257		188 - 84	

Egg masses collected Oct 5-11

4 Sheep pens

Tex. Mex Area

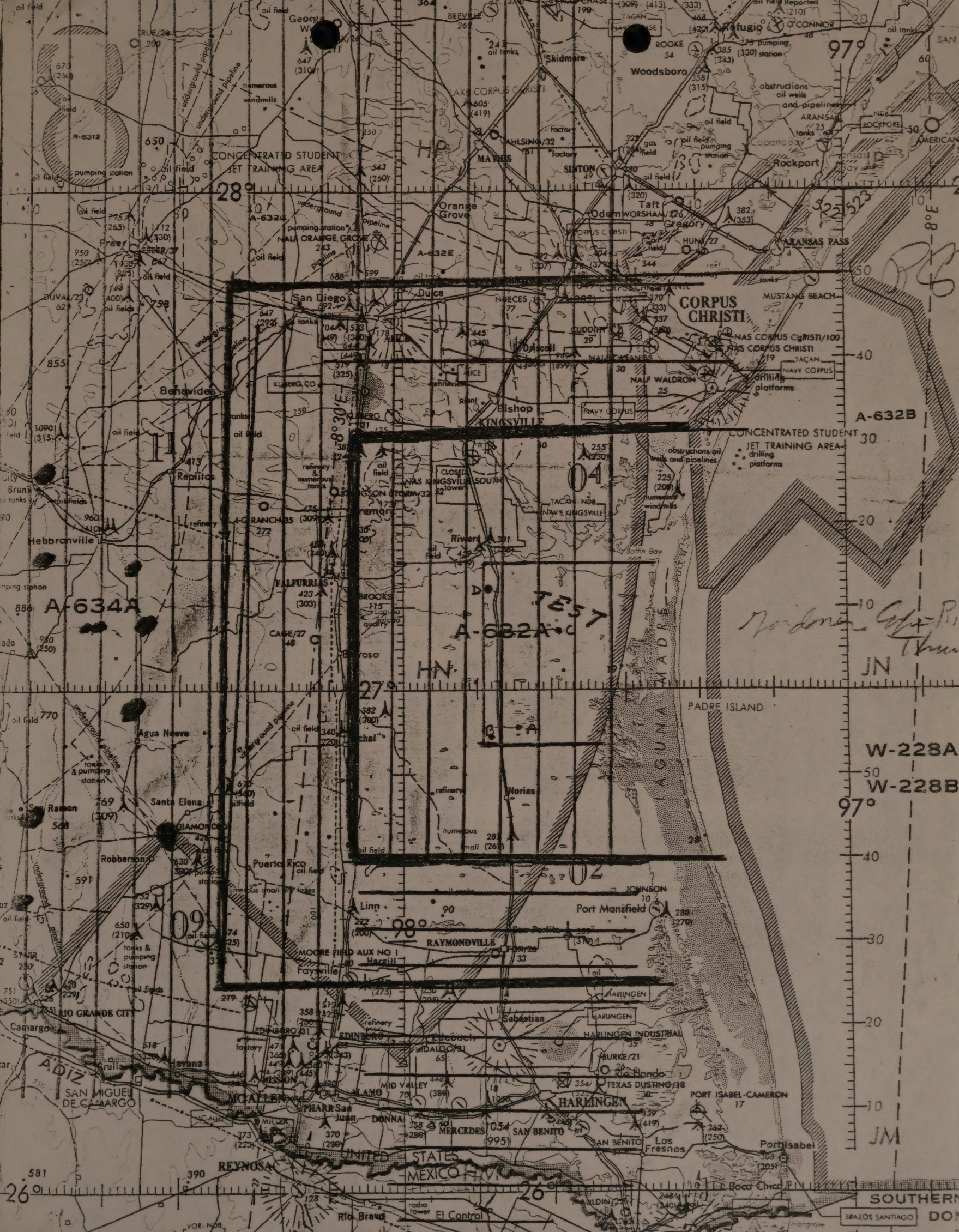
4 Sheep pens

APHIS Check

<u>Fertile</u>	<u>Sterile</u>	<u>90 % Sterile</u>	<u>Fertile</u>	<u>Sterile</u>	<u>90 % Sterile</u>
140	31	18.190	155	13	7.790

Flies released at 2000 ag/mi/wk
beginning Sept. 20. 1 release per week.

Release rate will be doubled
by twice weekly releases starting Nov 1



CONCENTRATED STUDENT
JET TRAINING AREA

CORPUS CHRISTI

HN

W-228A

W-228B

97°

40

30

20

10

SOUTHERN

BRAZOS SANTIAGO DON

A-632A

04

A-634A

JM

JN

PADRE ISLAND

Port Mansfield

RAYMONDVILLE

MOORE FIELD AUX NO 1

Santa Elena

Robberson

Camargo

San Miguel de Camargo

REYNOSA

PHARR

San Juan

DONNA

MERCEDES

SAN BENITO

LOS FRESNOS

PORT ISABEL

PORT ISABEL-CAMERON

LOS FRESNOS

PORT ISABEL

PORT ISABEL

PORT ISABEL

PORT ISABEL

PORT ISABEL

PORT ISABEL

PORT ISABEL

PORT ISABEL

GENETIC LOCI OF THE SCREW-WORM FLY
(Laboratory Strains Only)

December, 1973

TYPE	LOCUS	NAME	ADULTS	LARVAE	NO. ALLELES
<u>Protein</u>					
	P	Protein A	+	?	1
<u>Hydrolases and Lyases</u>					
	Amy	Amylase	+	+	2
	ACPH	Acid phosphate	+	0	1
	ALD-A	Aldolase-A	+	+	1
	ALD-B	Aldolase-B	0	+	1
	ALD-C	Aldolase-C	0	+	1
	APH-A	Alkaline phosphatase-A	+	+	1
	APH-B	Alkaline phosphatase-B	+	+	1
	β EST-A	β Esterase-A	+	0	4+
	α EST-B	α Esterase-B	+	0	2
	EST-C	Esterase-C	0	+	2+
	EST-D	Esterase-D	0	+	3+
	LAP-A	Leucine amino peptidase-A	0	+	1
	LAP-B	Leucine amino peptidase-B	+	+	2(?)
<u>Dehydrogenases</u>					
	ADH-A (HDH)	Alcohol dehydrogenase-A	+	+	1
	ADH-B (HDH)	Alcohol dehydrogenase-B	+	+	1
	α -GPD	α -Glycerophosphate	+	?	3
	IDH	Isocitrate dehydrogenase	+	+	1
	LDH	Lactate dehydrogenase			
	MDH-D	Malate dehydrogenase DPN dependent	+	?	1
	MDH-TA	Malate dehydrogenase TPN dependent-A	0	+	1
	MDA-TB	Malate dehydrogenase TPN dependent-B	+	+	1
	6-PGD	6-Phosphogluconic dehydrogenase	+	+	1
	G6PD	Glucose-6-phosphate	+	+	1
	SORB	Sorbital dehydrogenase	0	?	
	GDH	Glutamate dehydrogenase	+	?	1
	G3PD	Glyceraldehyde-3-phosphate	+	0	1
	GaldH	Galactose dehydrogenase	0	?	?
	Pep	Pepsinogen			

GENETIC LOCI OF THE SCREW-WORM FLY
(Laboratory Strains Only)

TYPE	LOCUS	NAME	ADULTS	LARVAE	NO. ALLELES
<u>Dehydrogenase Coupled Enzymes</u>					
	AK	Adenlate kinase	+	?	?
	Hex	Hexokinase	+	0	1
	PGI-A	Phosphoglucose isomerase-A	+	+	1
	PGI-B	Phosphoglucose isomerase-B	0	+	?
	PGM	Phosphoglucose mutase	+	+	3
	FUM	Fumarase	+	+	1
<u>Miscellaneous Enzymes</u>					
	GOT-A	Glutamate-oxaloacetate transaminase-A	0	+	1
	GOT-B	Glutamate-oxaloacetate transaminase-B	+	+	1
	GOT-C	Glutamate-oxaloacetate transaminase-C	0	+	2(?)
	Tyr	Tyrosinase	1 or 0	?	1
	AO	Aldehyde oxidase	+	0	1
	TO	Tetrazolium oxidase	+	0	1

Total number of loci examined = 36

Polymorphic in adults = 21.4% (6/28)

Polymorphic in larvae = 25% (6/24)

Polymorphic - all loci = 25% (9/36)

Preliminary isoenzyme analysis conducted by:

Dr. Guy L. Bush
Associate Professor of Zoology
Department of Zoology
University of Texas
Austin, Texas 78712

The eight polymorphic loci listed below are available for routine analysis when both larvae and adults are run from each population sampled.

	a-GDH	EST-A	EST-B	EST-C	AMY-A	PGM-A	ALD-A	GOT-A
Adults	+	+	+		+	+		
Larvae	+			+	+	+	+	+

Estimates of Genetic Variation at Five Loci in Two Mass-reared Adult Populations of the Screw-worm Fly

ESTERASE-A				
Strain	n	Alleles		
		1	2	3
Tex-Mex	43	.605	.186	.209
APHIS	44	.716	.011	.250

ESTERASE-B					
<u>Strain</u>	<u>n</u>	<u>Alleles</u>			
		<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
Tex-Mex	34	.441	.147	.118	.294
APHIS	35	.371	.129	.114	.386

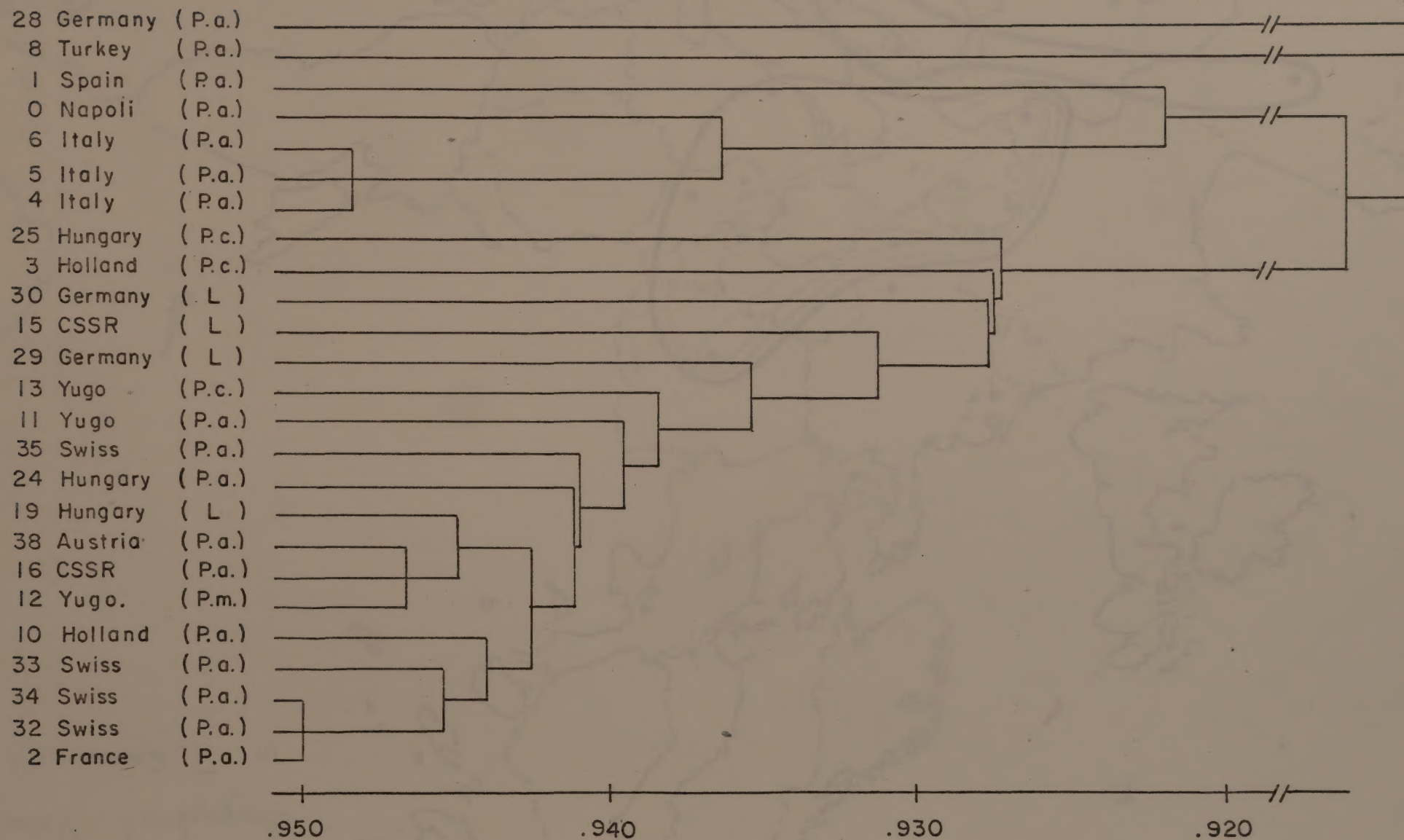
α -GLYCEROPHOSPHATE-A				
Strain	n	Alleles		
		1	2	
Tex-Mex	43	.930	.070	
APHIS	43	.872	.128	

PHOSPHOGLUCOSE MUTASE-A				
Strain	n	Alleles		
		1	2	3
Tex-Mex	43	0	1.000	0
APHIS	43	0	1.000	0

AMYLASE-A				
Strain	n	Alleles		
		1	2	
Tex-Mex	43	0	1.000	
APHIS	43	0	1.000	

CLUSTERING RESULTS

26 *R. cerasi* Populations



← SIMILARITY

Geographical Variation
in *R. Cerasi* (*P. avium*)



REFERENCE SLIP

12/13/73

TO

E. A. Taylor

- | | |
|---|---|
| ☐ ACTION | ☐ NOTE AND RETURN |
| ☐ APPROVAL | ☐ PER PHONE CALL |
| ☐ AS REQUESTED | ☐ RECOMMENDATION |
| ☐ FOR COMMENT | ☐ REPLY FOR SIGNATURE OF |
| ☒ FOR INFORMATION | ☐ RETURNED |
| ☐ INITIALS | ☐ SEE ME |
| ☐ NOTE AND FILE | ☐ YOUR SIGNATURE |

REMARKS You may be interested in this memo.

E. J. Ouye also sent me this on 12/13 and I sent him an uncredited copy of my letter letting him if we not get cleared but I wanted him to see that I didn't agree with all that he told me. Crocker

RECEIVED
DEC 17 1973
AREA OFFICE
WEBLACO, TEXAS

B.

FROM

M. T. Ouye
Program Analyst

1911

Abstract of the Report of the

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The following is a list of the
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Mr. Taylor
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XXXXXXXXXXXXXXXXXXXXXXXXXXXX

December 5, 1973

Dr. Norvan L. Mayer, Co-Director
Comision Mexico-Americana para la
Erradicacion del Gusano Barrenador
Leibnitz No. 20 - 12^o Piso
Mexico 5, D. F.

Dear Norvan:

Thank you for sending me a copy of your letter of November 19 to Dr. Hector Campos Lopez. To the best of my knowledge, this detailed report of the dipping vat tests of Compound 4072 in Tamaulipas is a completely accurate and impartial account of the tests and related incidents.

I would like to express my personal appreciation for your very sensitive handling of the more delicate international aspects of our activities and my personal regret that advance coordination between ARS and Sanidad Animal was inadequate. We all hope that the screwworm eradication program will be completely successful and assure you that ARS scientists in the field will support the program to the best of their abilities -- we want to be a positive force in the program, not a negative one.

Sincerely,

O. H. Graham

O. H. Graham
Research Entomologist
U. S. Livestock
Insects Laboratory

cc:

R. C. Bushland
H C Cox
E. A. Taylor ✓
J. L. Hourrigan
R. O. Drummond

RECEIVED

DEC 7 1973

AREA OFFICE
WESLACO, TEXAS

January 1, 1957

Mr. [Name] [Address]
[City] [State] [Zip]
[Phone Number]

Dear Mr. [Name]:
I am writing to you to inform you of the results of the [Project Name] which was conducted during the period of [Date Range]. The results of the project are as follows:

1. [Point 1]
2. [Point 2]
3. [Point 3]
4. [Point 4]
5. [Point 5]

Sincerely,
[Signature]
[Name]
[Title]

cc: [List of recipients]
[Name]
[Title]
[Address]
[City] [State] [Zip]

RECEIVED

DEC 1 1956
AIRMAIL
WESTLAND, TEXAS

DRAFT 12/5/73

Dr. Héctor Campos López
Director General Sanidad Animal
Doctor Mora No. 15 - 9^o Piso
Mexico 1, D. F.

Dear Dr. Campos López:

It was a pleasure to make your acquaintance at the time of my visit to Mexico City on November 17, and I appreciated the opportunity to discuss some of our research programs with you. ^{as} ^{were,} Like you, I was quite concerned about the problems that had arisen in connection with the evaluations of Supona as a livestock dip in Tamaulipas and deeply regret that animals were poisoned in the course of these tests. Undoubtedly most of these losses could have been avoided had the trials been more carefully planned and coordinated.

Dr. Norvan Meyer has very kindly provided me with a copy of his letter of November 19 to you. I feel that Dr. Meyer has written a very accurate report of the tests and of the events that preceded them. It is now clear that ARS employees acted without proper formal approval, but I would like to assure you that any neglect on our part was not intentional. In addition, you may be assured that, if an apparent need for research in Mexico that would involve livestock develops in the future, appropriate proposals will be presented to your agency and concurrence will be obtained before any further plans are made. For many years we have coordinated research on

Dr. Hector Campos Lopez
Director General Sanidad Animal
P.O. Box No. 12 - 9° Place
Mexico 1, D. F.

Dear Dr. Campos Lopez:

It was a pleasure to make your acquaintance at the time of my visit to Mexico City on November 13, and I appreciated the opportunity to discuss some of our research programs with you. Like you, I was quite concerned about the problems that had arisen in connection with the evaluation of Baboon as a livestock dip in Tamaulipas and deeply regret that animals were poisoned in the course of these tests. Undoubtedly most of these losses could have been avoided had the trials been more carefully planned and coordinated.

Dr. Norman Meyer has very kindly provided me with a copy of his letter of November 13 to you. I feel that Dr. Meyer has written a very accurate report of the tests and of the events that preceded them. It is now clear that all employees acted without proper formal approval, and I would like to assure you that any neglect on our part was not intentional. In addition, you may be assured that, if an apparent need for research in Mexico that would involve livestock develops in the future, appropriate proposals will be presented to your agency and concurrence will be obtained before any further plans are made. For many years we have coordinated research on

2

agricultural pests with Sanidad Vegetal and Instituto Nacional de Investigaciones Agricolas, and will be happy to do the same with Sanidad Animal if animals will be studied.

Sincerely

H C Cox
Associate Deputy Administrator

agricultural parts with Sanidad Vegetal and Instituto Nacional de Investigaciones Agrícolas, and will be happy to do the same with Sanidad Animal if animals will be studied.

Sincerely

H. C. Cox
Associate Deputy Administrator

REFERENCE SLIP

12/1, 73

TO

B. G. Hightower

- | | |
|--|---|
| ☐ ACTION | ☐ NOTE AND RETURN |
| ☐ APPROVAL | ☐ PER PHONE CALL |
| ☐ AS REQUESTED | ☐ RECOMMENDATION |
| ☐ FOR COMMENT | ☐ REPLY FOR SIGNATURE OF |
| ☐ FOR INFORMATION | ☐ RETURNED |
| ☐ INITIALS | ☐ SEE ME |
| ☐ NOTE AND FILE | ☐ YOUR SIGNATURE |

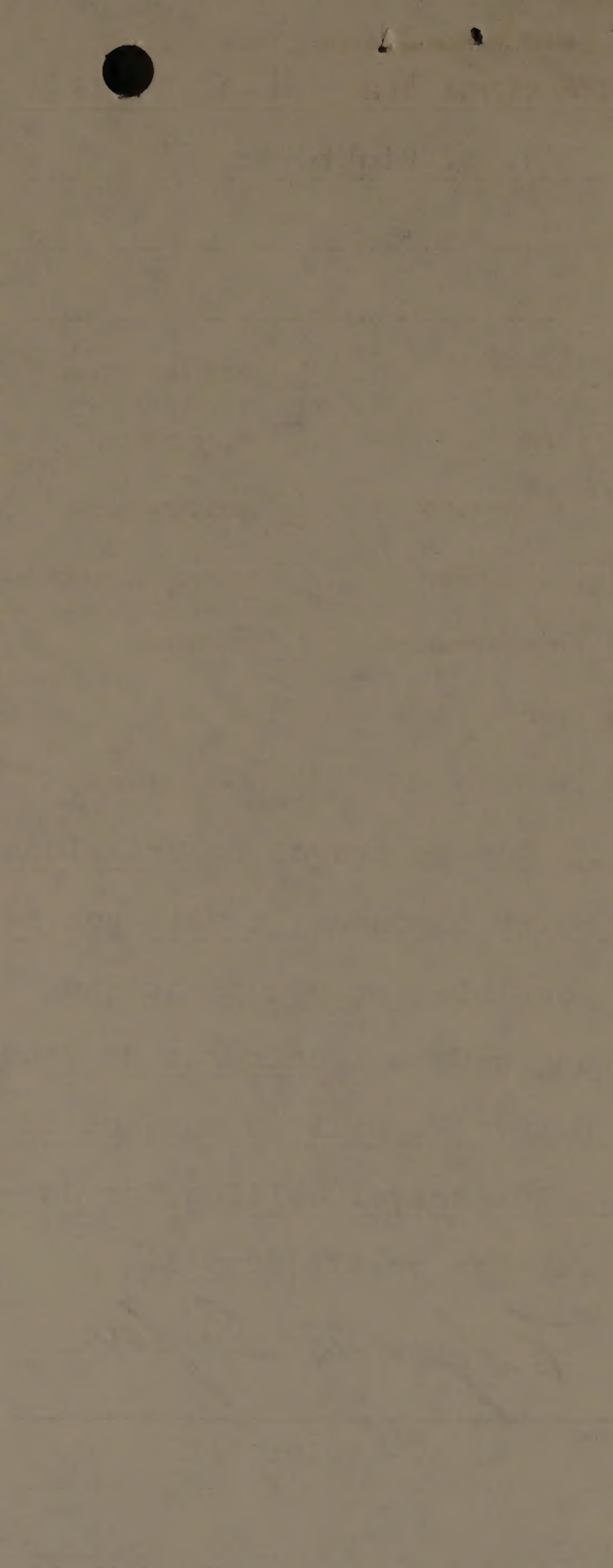
REMARKS

Due to travel restrictions being imposed, it will not be possible for you to attend and give a lecture at MS State Univ. We will be subject to a 20% travel ceiling for Jan-Feb-Mar on all travel.

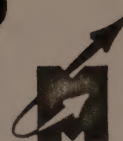
E. A. Taylor

FROM

E. A. Taylor, AD



COLLEGE OF AGRICULTURE • AGRICULTURAL AND FORESTRY EXPERIMENT STATION
MISSISSIPPI STATE UNIVERSITY



DEPARTMENT OF ENTOMOLOGY
DRAWER EM
MISSISSIPPI STATE, MISSISSIPPI 39762
PHONE (601) 325-4541

October 19, 1973

Dr. B. G. Hightower
Screwworm Research Laboratory
Box 986
Mission, Texas 78572

Dear Billie Gene:

Dr. Maxwell and I are developing a graduate level course in insect rearing techniques to be taught in the Entomology Department here at MSU during the spring semester. The course will begin in mid-January and continue through April.

I am writing you at this time about this course to officially invite you to give a lecture in the course. I might add that we have approximately 25 scientists located in various entomological installations in Mississippi giving lectures in the course. We are asking each entomology lecturer to do so for a period of one hour. Also we are requesting that you prepare a synopsis of your lecture and give it to us at the time you present it.

We are hopeful that you will accept this assignment; and if you can accept, please give us the preferred time you would like to come and I will schedule your lecture in the course. We will also plan to send each person a complete outline of all the speakers and topics at the completion of the plans for the course. Incidentally, I am utilizing staff members from the Entomology Department, Boll Weevil Lab, Bioenvironmental Lab at Stoneville, Marion Laster at Stoneville, and the USDA Forest Insect people at Stoneville and Gulfport. Also, I am asking Joe Lewis, Jim Brazzel and Dick Ridgway to present lectures, along with you.

May I have your response to this at an early date? With kindest regards,

Sincerely yours,

C. Arlie Wilson
C. Arlie Wilson
Professor of Entomology

FILE: SECTION Correspondence
SUBJECT Screwworm Res
FOLDER _____

CAW/mg

MISSISSIPPI STATE

Mr. J. B. ...
...
...

Dear Sir:

...

...

...

FILE: SECTION _____
SUBJECT _____
FOLDER _____

FILE SECTION
SUBJECT
FOLDER

SUBTROPICAL TEXAS AREA
P. O. Box 267
Weslaco, Texas 78596

December 20, 1973

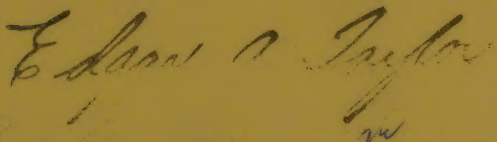
Subject: Acting Research-Location Leader, Screwworm
Research, Mission, Texas

To: A. W. Cooper, Deputy Administrator
Southern Region, ARS-USDA
New Orleans, LA

As you know R. C. Bushland, Research Leader, Screwworm Research, has elected to retire effective December 29, 1973. His retirement marks a total reduction of research effort on screwworm from six to three SMYs. (G. W. Eddy retired effective June 30, 1973 and R. R. Grabbe resigned effective Sept. 29, 1973.) The attractant research, for all practical purposes, was discontinued with Dr. Grabbe's departure.

With the upcoming executive meeting at Mission, as well as the urgency to maintain a continuous screwworm research program, we recommend that O. H. Graham be assigned to temporary duty to the position of Acting Research-Location Leader for this program, pending the selection of a permanent research leader. G. W. Eddy and R. R. Grabbe's positions also need to be filled, but these two positions can be deferred until after the executive meeting in January. Also, the new permanent research leader should have a strong hand in selecting these two replacements.

I have discussed this assignment with Dr. Graham and he indicated that he is willing to accept a temporary duty assignment to Mission for a period of one to six months, depending upon ARS needs and priorities.



E. A. Taylor
Area Director

cc:
L. Henderson
R. C. Bushland
O. H. Graham

ARS:SR:EATaylor:nc 12/20/73

CONFIDENTIAL
J. O. B. 107
10/10/55

November 10, 1955

Subject: Acting Research Assistant, Research
Mission, Alaska

Re: A. W. B. 107, Deputy Assistant
Research Mission, Alaska
New Orleans, LA

As you know, K. C. B. 107, Research Assistant, Research
Mission, was elected to Acting effective December 15, 1955.
His assignment was a total reduction of research effort
on November 15, 1955. (G. W. B. 107)
Effective June 15, 1955, K. C. B. 107 was assigned effective
June 15, 1955. The attached research, for all practical
purposes, was discontinued with Dr. Graham's departure.

With the upcoming executive meeting at Alaska, as well as
the Agency to maintain a continuous research effort
program, we recommend that O. H. Graham be retained to
continue duty to the position of Acting Research Assistant
for this program, pending the election of a permanent
Research Assistant. G. W. B. 107 and K. C. B. 107's positions
also need to be filled, but these two positions can be
filled until after the executive meeting in January. Also,
the new permanent Research Assistant should have a strong hand
in selecting these two replacements.

I have discussed this assignment with Dr. Graham and he
indicated that he is willing to accept a temporary duty
assignment to Alaska for a period of one to six months,
depending upon his needs and interests.

[Handwritten signature]

A. W. B. 107
Research Assistant

C. C. B. 107
Research Assistant
K. C. B. 107
Research Assistant
G. W. B. 107

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
SOUTHERN REGION
SUBTROPICAL TEXAS AREA
P. O. Box 267
Weslaco, Texas 78596

December 20, 1973

Subject: Acting Research-Location Leader, Screwworm
Research, Mission, Texas

To: A. W. Cooper, Deputy Administrator
Southern Region, ARS-USDA
New Orleans, LA

As you know R. C. Bushland, Research Leader, Screwworm Research, has elected to retire effective December 29, 1973. His retirement marks a total reduction of research effort on screwworm from six to three SMYs. (G. W. Eddy retired effective June 30, 1973 and R. R. Grabbe resigned effective Sept. 29, 1973.) The attractant research, for all practical purposes, was discontinued with Dr. Grabbe's departure.

With the upcoming executive meeting at Mission, as well as the urgency to maintain a continuous screwworm research program, we recommend that O. H. Graham be assigned to temporary duty to the position of Acting Research-Location Leader for this program, pending the selection of a permanent research leader. G. W. Eddy and R. R. Grabbe's positions also need to be filled, but these two positions can be deferred until after the executive meeting in January. Also, the new permanent research leader should have a strong hand in selecting these two replacements.

I have discussed this assignment with Dr. Graham and he indicated that he is willing to accept a temporary duty assignment to Mission for a period of one to six months, depending upon ARS needs and priorities.

E. A. Taylor

E. A. Taylor
Area Director

cc:
L. Henderson
R. C. Bushland
O. H. Graham

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
SOUTHERN REGION
SUBTROPICAL TEXAS AREA
P. O. Box 267
Weslaco, Texas 78596

December 20, 1973

Subject: Acting Research-Location Leader, Screwworm
Research, Mission, Texas

To: A. W. Cooper, Deputy Administrator
Southern Region, ARS-USDA
New Orleans, LA

As you know R. C. Bushland, Research Leader, Screwworm
Research, has elected to retire effective December 29, 1973.
His retirement marks a total reduction of research effort
on screwworm from six to three SMYs. (G. W. Babb retained
effective June 30, 1973 and R. R. Graphe resigned effective
Sept. 29, 1973.) The attendant research, for all practical
purposes, was discontinued with Dr. Graphe's departure.

With the upcoming executive meeting at Mission, as well as
the urgency to maintain a continuous screwworm research
program, we recommend that O. H. Graham be assigned to
temporary duty to the position of Acting Research-Location
Leader for this program, pending the selection of a permanent
Research Leader. G. W. Babb and R. R. Graphe's positions
also need to be filled, but these two positions can be
deferred until after the executive meeting in January. Also,
the new permanent research leader should have a strong hand
in selecting these two replacements.

I have discussed this assignment with Dr. Graham and he
indicated that he is willing to accept a temporary duty
assignment to Mission for a period of one to six months,
depending upon ARS needs and priorities.

E. A. Taylor
Area Director

cc:
L. Henderson
R. C. Bushland
O. H. Graham

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
SOUTHERN REGION
SUBTROPICAL TEXAS AREA

December 20, 1973

Science
1515 Massachusetts Ave. N.W.
Washington, D. C. 20005

Editor:

John Calman and Roger H. Smith (Letters, 23 Nov. 1973, p. 775) commented adversely on the status of the Southwestern Screwworm Eradication Program. This program is conducted by the U.S. Department of Agriculture with the cooperation of livestock regulatory agencies, extension services, and grower organizations in affected U.S. states and Mexico. The program is conducted by USDA's Animal and Plant Health Inspection Service (APHIS), with research support from the Agricultural Research Service (ARS).

There could be many reasons for our recent difficulty in keeping screwworm, Cochliomyia hominivorax, populations from growing and spreading in this country. There are ecological as well as genetic and physiological considerations. Abundant rainfall for the past two years has favored screwworm increase in the warm months. An unusually mild winter in 1971-72 aided survival of this subtropical insect.

The sterile insect release program was designed on the assumption that most growers take good care of their livestock. We believed that the release of 100 million sterile flies per week would overwhelm the native flies that bred in wildlife and neglected domestic animals. Almost complete freedom from screwworms since 1964 has permitted Southwestern ranchers to save more than \$100 million (1962 dollars) annually in costs of labor and insecticides previously spent for screwworm control. When screwworms reappeared in 1972, cattlemen could not immediately return to the ranch practices of 10 years ago. Because of a lack of skilled cowboys, trained cow horses, spray pens, dipping vats, and special holding pastures, ranchers could not prevent screwworm breeding in their herds, so these became a new class of "neglected" livestock.

Starting in 1968, APHIS increased production to 200 million sterile flies weekly, but these numbers, spread over northern Mexico and the adjoining U.S. states, were inadequate for an effective barrier in 1972 and again in 1973. The situation in Texas in 1973 was much better than it was in 1972. In 1973 only an area south of Laredo and Corpus Christi suffered inadequate control. Most of the cases occurred in five counties where an uncontrolled outbreak of Gulf Coast ticks, Amblyomma maculatum, made thousands of cattle unusually susceptible to screwworms. In spite of local failures, chiefly in Texas and Arizona during the past two years, the situation was not as disastrous as Calman indicated. The 1972 infestation north of Texas was minor, occurring late in the season, and was quickly terminated by cold weather. Considering the area of the U.S. subject to screwworm losses before the sterile fly program, the vast majority of animals are still protected, to the benefit of producers, consumers and wildlife.

Although we defend the eradication program for its obvious benefits, ARS is not complacent about the need for supportive research. For those interested in references to investigations, I cite review papers (1, 2, 3, 4) by scientists who have actually done screwworm research and not merely written about it. In this letter I touch on the past year's unpublished research of Mission, Texas entomologists listed alphabetically: APHIS--E. H. Ahrens, E. C. Corristan, A. J. Graham and H. C. Hofmann; ARS--R. C. Bushland, M. M. Crystal, G. W. Eddy, R. R. Grabbe, O. H. Graham, B. G. Hightower and C. M. Jones.

The problems in screwworm genetics cited by Smith have received attention. The APHIS screwworm breeding stock at Mission is not descended from the original Florida colony used at the beginning of the program. To prevent the loss of field adaptation through prolonged laboratory rearing, breeding stocks have been completely changed three times during the course of the program. In 1966 a strain developed from flies collected in Mexico replaced the Florida strain. In 1971 that strain was replaced by another laboratory strain of Mexican origin, and in 1972 a new strain developed from flies collected in Texas at the beginning of the outbreak became the current APHIS production strain.

We made many collections of screwworms from infested livestock at diverse locations in Texas and Mexico during 1972 and 1973 to establish laboratory populations for mating tests in cages. In all tests the laboratory strains have mated with the newly colonized flies. In competitiveness tests, the old laboratory-adapted strains of sterilized males mated more successfully with wild-type females than did fertile wild-type males.

Working jointly with the Methods Development Section of APHIS, we have conducted a series of field evaluations in Texas and Tamaulipas, Mexico. The APHIS-ARS entomological team found in release and trap-back tests that a new strain of flies (designated Tex-Mex) developed from collections made in 1972 at 18 locations in Texas and 6 in Mexico, seemed to migrate farther, faster, and survive longer than the current APHIS production strain. Both strains are now being compared for mating competitiveness against wild flies on 2,000-sq-mi. plots in South Texas.

We have brought many additional collections into the laboratory to breed for genetic and physiological studies. We are combining some of these stocks, attempting to develop a better strain.

Although mild winters, rainy summers, and changed ranch practices have favored screwworms in nature, there may also have been genetic changes in the wild population. Field experiments have convinced me that our sterile males are not now mating as effectively with wild females as we might expect on the basis of tests with caged flies.

I think that the northern fringe of the wild population may have evolved mechanisms that isolate them from sterile flies in the barrier zone. Rearing the larvae on artificial media produces flies visibly different from those that grow in wounds. The sterile flies are not as large as wild flies, and their color is a different shade of blue. There are undoubtedly other deficiencies in artificially reared flies that wild flies might detect. There could also have evolved isolating mechanisms that do not involve rejection of sterile males, but rather factors in dispersal, aggregation or mating behavior that keep wild and sterile flies from intermingling at mating time. We are planning a field release in southern Mexico, where the wild population has not been exposed to sterile flies, and a similar release of sterile flies in northern Mexico to see if there is a difference in the proportion of sterile matings.

We are aided in our work at Mission by geneticists, physiologists, and chemists from other ARS laboratories at Fargo, ND; Kerrville, TX; Florence, SC; and Gainesville, FL who have come here on temporary duty to work under quarantine with fertile flies before returning to their home laboratories to continue analysis of frozen specimens and to experiment with sterile flies shipped to them by APHIS.

We are further aided by screwworm research contracts with the University of Texas at Austin (isozyme studies in population genetics); Instituto Tecnológico y de Estudios Superiores de Monterrey, Monterrey, Mexico (studies on screwworm ecology and collection of new strains in northern Mexico); and Instituto Nacional de Investigaciones Agrícolas, Estados Unidos Mexicanos (INIA) (trapping studies, effects of weather on populations and collections of new strains in southern Mexico).

I regretfully agree with Calman that "no one has gotten to the bottom of it"--but we are digging.

R. C. Bushland

R. C. Bushland
Research Leader
Screwworm Research Laboratory
Agricultural Research Service, USDA
Mission, Texas 78572

REFERENCES

1. R. C. Bushland, Advances in Pest Control Research. 3: 1 (1960).
2. A. H. Baumhover. J. Am. Med. Assoc. 196. 240 (1966).
3. L. E. LaChance, C. H. Schmidt and R. C. Bushland, Pest Control. 4: 147 (1967).
4. B. G. Hightower and O. H. Graham, In Control of Livestock Insects by the Sterile Male Technique. Int. Atom. En. Agency, Vienna. 51 (1968).

EAT
H.C. Cox
1-7-73
J.E.

copy

Screwworm Research Laboratory
P. O. Box 986
Mission, Texas 78572

December 27, 1973

Subject: Dr. Ray Moore's Insect Nutrition Studies

To: Waldemar Klassen
USDA, ARS, National Program Staff
Beltsville, Maryland 20705

Dr. Moore returned to Florence, S. C., two weeks ago. I assume that by now you have received his preliminary report.

Although Dr. Moore did not solve the problem of artificially rearing flies that resemble wound-reared insects, he made a very good start. I was greatly impressed with his ability and dedication. He is continuing the work in absencia guiding our technician, Bobby Handke, by long distance telephone for another month.

Dr. Meadows of APHIS, after hearing Dr. Moore's final report said that if ARS couldn't permanently assign a nutritionist of Dr. Moore's calibre to work at Mission, that he would request such a person for his APHIS Methods Development Staff.

When the Mission laboratory has its informal program review on January 22 and 23, I hope that you can arrange for Dr. Moore to be here to discuss screwworm rearing.

R. C. Bushland
Research Leader

cc: ✓ E. A. Taylor
L. S. Henderson
Ray Moore

FILE: SECTION Research
SUBJECT Screwworm
FOLDER Dr. Cox

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DEC 28

AREA OFFICE
WESLACO, TEXAS

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